

The Scottish Salmon Company



Environmental Monitoring Plan

North Arran Marine Fish Farm
CAR/L/1181033

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Glossary

DGPF	Differential Global Position Fixing
EMP	Environmental Monitoring Plan
MPFF	Marine Pen Fish Farm
PMF	Priority Marine Feature
PSA	Particle Size Analysis
PSWP	Permitted Substances Working Plan
SEPA	Scottish Environmental Protection Agency
TOC	Total Organic Carbon



1. Introduction

1.1 Aim

The aim of this Environmental Monitoring Plan (EMP) is to monitor the impacts from a Marine Pen Fish Farm (MPFF) in order to assess compliance with relevant environmental quality standards.

1.2 Scope of Survey

Self-monitoring shall be carried out by or on behalf of the responsible person in accordance with the relevant schedules of the licence.

1.3 Sampling Strategies and Protocols

Two sampling strategies are applied as part of this EMP.

A. Benthic Monitoring Survey B. In-feed Treatment Residues

2. General Conditions

2.1 Species of fish

The discharge shall be of trade effluent and solid waste matter arising from the farming of Atlantic salmon in pens at the premises.

2.2 Maximum Weight of Fish

The maximum weight of fish held at the premises at any time during which the discharge arises shall not exceed 2300 tonnes.

2.3 Permitted Medicines and Chemicals

The discharge may contain the medicines and chemicals specified in **Table 1** when discharged in accordance with the licence conditions.

Table 1 Permitted Medicines and Chemicals

Medicine/ Chemical Type	Trade Name	Active Ingredient
Anti-parasitic	Salmosan/Salmonsan Vet, Azasure	Azamethiphos
Anti-parasitic	SLICE	Emamectin Benzoate
Anti-parasitic	AMX or ALPHAMAX	Deltamethrin



2.4 Permitted Substances List (PSL)

In addition to the medicines and chemicals set out in **Table 1** above, the discharge may contain the medicines and chemicals set out in the stated Permitted Substances List.

3. Benthic Monitoring Survey

3.1 Survey Design

The responsible person shall carry out the following monitoring plan in accordance with the outlined criteria below.

3.1.1 Transects

This environmental seabed monitoring survey is based upon multiple transects with multiple sampling stations located on each transect. A minimum of four transects, originating at the pen edges should be monitored per group. Two of these should be oriented along the major axis of the allowable mixing zone and two along the minor axis.

An extended transect will be monitored to cover the area in-between both groups. This will allow the extent of each footprint to be calculated.

Sampling stations are sufficiently spaced to allow a gradient or trend of impact to be determined along a transect, and will be at least 10 metres apart.

NewDEPOMOD has been used to identify sampling transects directions and distances to the edge of the allowable mixing zone.

3.2 Benthic Survey Strategy

Table 2 and 3 outline the benthic monitoring station positions, **Figure 1** illustrates the site specific mixing zone area and **Figure 2** illustrates the benthic monitoring station locations. **Table 4** details the pen centre locations.



Table 2 South Group Benthic Monitoring Station Positions

Transect	Bearing (°)	Distance (m)	Station	Easting	Northing
S1	136	0	S1-A	199839	649348
S1	136	25	S1-B	199857	649330
S1	136	50	S1-C	199874	649312
S1	136	75	S1-D	199891	649294
S1	136	100	S1-E	199909	649276
S1	136	125	S1-F	199926	649258
S1	136	150	S1-G	199943	649240
S2	325	0	S2-A	199749	649531
S2	325	32.5	S2-B	199730	649556
S2	325	65	S2-C	199712	649582
S2	325	97.5	S2-D	199693	649609
S2	325	162.5	S2-F	199656	649662
S2	325	162.5	S2-F	199656	649662
S2	325	195	S2-G	199637	649689
S2	325	227.5	S2-H	199619	649715
S3	39.6	0	S3-A	199830	649483
S3	39.6	25	S3-B	199846	649502
S3	39.6	50	S3-C	199862	649522
S3	39.6	75	S3-D	199878	649541
S3	39.6	100	S3-E	199894	649560
S3	39.6	125	S3-F	199910	649579
S3	39.6	150	S3-G	199926	649599
S4	220.8	0	S1-A	199757	649397
S4	220.8	25	S1-B	199740	649378
S4	220.8	50	S1-C	199724	649359
S4	220.8	75	S1-D	199708	649340
S4	220.8	100	S1-E	199691	649321
S4	220.8	125	S1-F	199675	649302
S4	220.8	150	S1-G	199659	649283



Table 3 North Group Benthic Monitoring Station Positions

Transect	Bearing (°)	Distance (m)	Station	Easting	Northing
N1	334.7	0	N2-A	199337	650041
N1	334.7	25	N2-B	199326	650064
N1	334.7	50	N2-C	199315	650087
N1	334.7	75	N2-D	199305	650109
N1	334.7	100	N2-E	199294	650132
N1	334.7	125	N2-F	199283	650154
N1	334.7	150	N2-G	199273	650177
N2	145.0	0	N1-A	199487	649903
N2	145.0	32.5	N1-B	199506	649876
N2	145.0	65	N1-C	199524	649850
N2	145.0	97.5	N1-D	199543	649823
N2	145.0	130	N1-E	199562	649796
N2	145.0	162.5	N1-F	199580	649770
N2	145.0	195	N1-G	199599	649743
N3	64.8	0	N3-A	199465	649995
N3	64.8	25	N3-B	199487	650005
N3	64.8	50	N3-C	199510	650016
N3	64.8	75	N3-D	199533	650027
N3	64.8	100	N3-E	199555	650037
N3	64.8	125	N3-F	199578	650048
N3	64.8	150	N3-G	199601	650059
N4	242.4	0	N4-A	199362	649948
N4	242.4	25	N4-B	199340	649936
N4	242.4	50	N4-C	199318	649925
N4	242.4	75	N4-D	199295	649913
N4	242.4	100	N4-E	199273	649902
N4	242.4	125	N4-F	199251	649890
N4	242.4	150	N4-G	199229	649878

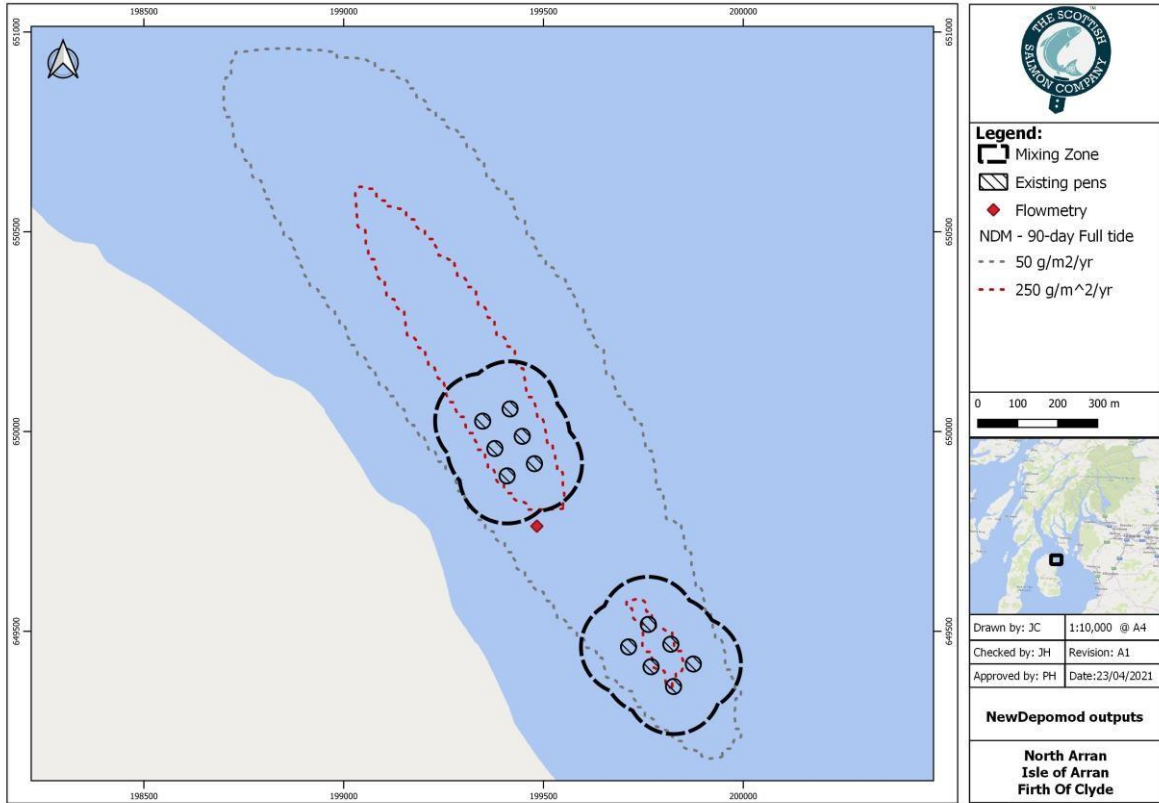


Figure 1 North Arran Mixing Zone

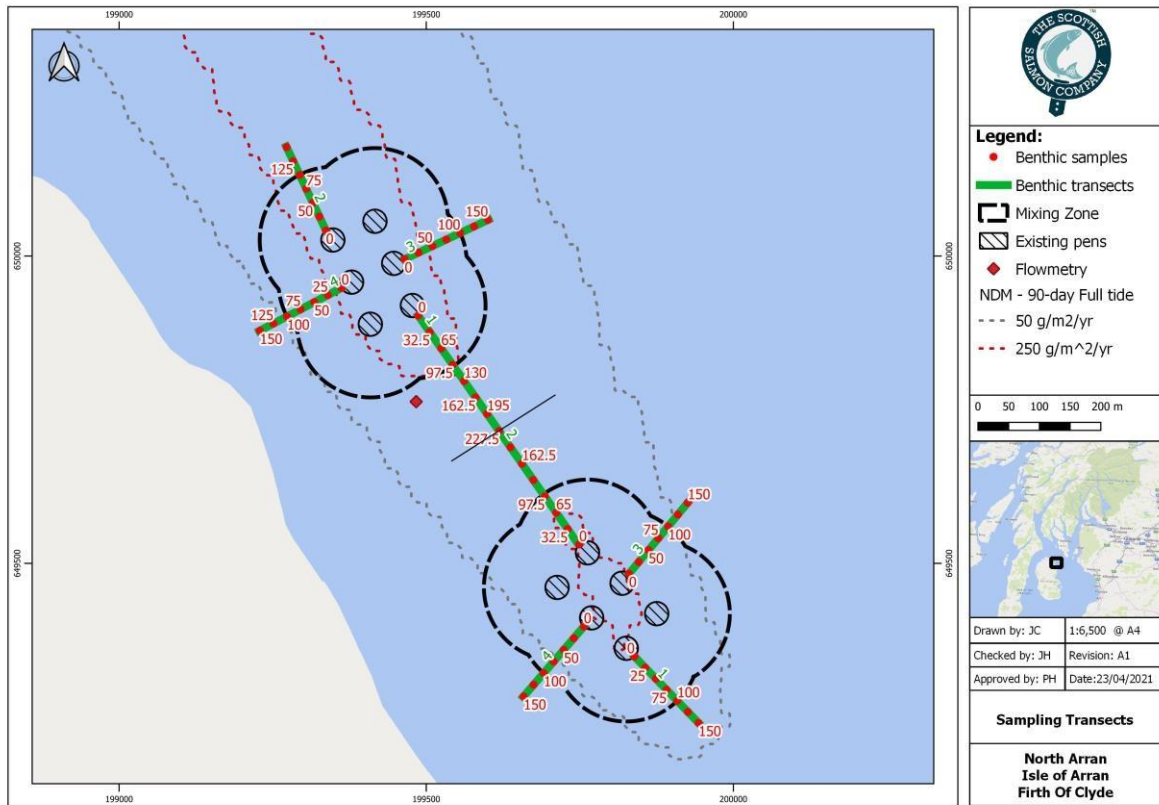


Figure 2 North Arran Benthic Monitoring Station Locations

**Table 4 North Arran Pen Centre Locations**

Pen	Easting	Northing
N-1	199417	650057
N-2	199348	650026
N-3	199447	649988
N-4	199379	649957
N-5	199478	649919
N-6	199409	649889
S-7	199763	649517
S-8	199819	649468
S-9	199713	649461
S-10	199875	649418
S-11	199769	649411
S-12	199826	649362

3.3 Mixing Zone Area

The allowable mixing zone is 217,455 m².

3.4 Survey Timing

The responsible person shall carry out the monitoring programme when it is probable that the greatest impact will be observed from the site. This is expected to be within the 30 day period either side of the date that fish biomass on the site has reduced to 75 % of the peak biomass for the last time during that cycle; but will not take place within 14 days of peak biomass.

3.5 Sampling Requirements

At each suitable sediment sampling station, grab samples will be collected and analysed for the following parameters:

- Benthic Invertebrates;
- Particle Size Analysis (PSA);
- Total Organic Carbon (TOC); and In-feed Treatment Residues.

The number of sample taken for each station are detailed in **Table 5 and 6** (based on collection using a 0.045 m² Van Veen grab).



Table 5 South Group Samples per Benthic Survey Station

Station	Benthic Invertebrates	Particle Size Analysis (PSA)	Total Organic Carbon (TOC)	In-feed Treatment Residues
S1-A	2	1	1	3
S1-B	2	1	1	3
S1-C	2	1	1	3
S1-D	2	1	1	3
S1-E	2	1	1	3
S1-F	2	1	1	3
S1-G	2	1	1	3
S2-A	2	1	1	3
S2-B	2	1	1	3
S2-C	2	1	1	3
S2-D	2	1	1	3
S2-F	2	1	1	3
S2-F	2	1	1	3
S2-G	2	1	1	3
S2-H	2	1	1	3
S3-A	2	1	1	3
S3-B	2	1	1	3
S3-C	2	1	1	3
S3-D	2	1	1	3
S3-E	2	1	1	3
S3-F	2	1	1	3
S3-G	2	1	1	3
S1-A	2	1	1	3
S1-B	2	1	1	3
S1-C	2	1	1	3
S1-D	2	1	1	3
S1-E	2	1	1	3
S1-F	2	1	1	3
S1-G	2	1	1	3

**Table 6 North Group Samples per Benthic Survey Station**

Station	Benthic Invertebrates	Particle Size Analysis (PSA)	Total Organic Carbon (TOC)	In-feed Treatment Residues
N1-A	2	1	1	3
N1-B	2	1	1	3
N1-C	2	1	1	3
N1-D	2	1	1	3
N1-E	2	1	1	3
N1-F	2	1	1	3
N1-G	2	1	1	3
N2-A	2	1	1	3
N2-B	2	1	1	3
N2-C	2	1	1	3
N2-D	2	1	1	3
N2-E	2	1	1	3
N2-F	2	1	1	3
N2-G	2	1	1	3
N3-A	2	1	1	3
N3-B	2	1	1	3
N3-C	2	1	1	3
N3-D	2	1	1	3
N3-E	2	1	1	3
N3-F	2	1	1	3
N3-G	2	1	1	3
N4-A	2	1	1	3
N4-B	2	1	1	3
N4-C	2	1	1	3
N4-D	2	1	1	3
N4-E	2	1	1	3
N4-F	2	1	1	3
N4-G	2	1	1	3
N1-A	2	1	1	3

Field notes will accompany samples and shall include any observation on weather conditions, position fixing problems and a visual description of sediment.

Where a sampling station is located over an area that is not suitable for sampling (i.e. hard substrate habitats and/ or some types of Priority Marine Features (PMF)), SEPA will be contacted to discuss alternative methods of assessing conditions e.g. collection of visual survey footage.

3.6 Survey Protocol



3.6.1 Position Fixing

All sampling locations shall have positions recorded. The method used for position fixing shall be Differential Global Position Fixing (DGPS). The position of any samples shall be fixed as near to the exact time the samples are taken (when the grab hits the bottom). The position will be returned to until all samples have been collected.

3.6.2 Sample Collection

All sampling equipment will be inspected prior to use to ensure that it is in good working order. The grab shall be washed out prior to use and between the collection of each sample.

Samples shall be taken using a 0.045 m² Van Veen grab with top opening flaps for sediment access and visual inspection. Where appropriate, a 0.1 m² Day grab may also be used.

On recovery of the grab both the volume and characteristics of the sediment shall be noted. Any grab found to be incomplete shall be rejected and another grab taken. The volume of sediment which is deemed satisfactory shall depend on the site specific survey area conditions.

When using both the 0.045 m² Van Veen grab two replicates shall be collected for faunal analysis. Samples shall be collected from separate grabs and not subsampled.

At each sampling location a minimum of two samples shall be collected to provide sediment samples for chemical and infeed residue analysis, and two samples for faunal analysis.

Sampling should be carried out in accordance with 'Interim Performance Standard MACS-FFA-02'.

3.6.3 Sample Labelling

All samples pots shall be cleaned before use to prevent contamination. Each sample shall be clearly labelled with an external label along with an internal label written on waterproof paper. The label will contain sufficient information to ensure the sample can be uniquely identified.

If a sample requires splitting into more than one pot these shall be labelled appropriately e.g. "1 of 2", and "2 of 2" etc.

3.6.4 Sediment Characterisation: Visual Assessment

A report on the condition of the sediment noting colour, consistency and texture shall be made. The presence of any feed pellets, *Beggiatoa* and depth of any overlying organic sediment shall be noted.

3.6.5 Sediment Characterisation: Total Organic Carbon (TOC)

As a minimum at each sampling station, one subsample of sediment shall be taken as a core to 5cm, and should be stored in an air tight container.

Samples shall be kept in a cool box until they can be frozen for later analysis. Samples will be frozen on the day of collection.



3.6.6 Sediment Characterisation: Particle Size Analysis (PSA)

As a minimum at each sampling location, one subsample of sediment shall be collected using a corer to 5cm.

Samples shall be kept in a cool box until they can be frozen for later analysis. Samples will be frozen on the day of collection. Analysis will be by dry sieving and laser granulometry.

3.6.7 In-feed Treatment Residues

Three sediment cores shall be taken to a depth of 5 cm and kept as separate replicates.

Samples shall be kept in a glass container with a metal-foiled sealed lid.

Samples shall be kept in a cool box until they can be frozen for later analysis. Samples will be frozen on the day of collection.

3.6.8 Benthic Biology: Sample Preparation

Prior to sampling, the grab, sieve and any containers will be cleaned and rinsed to prevent any cross contamination. All replicate samples will be processed separately after collection.

Samples shall be sieved after collection using seawater through a 1 mm metal mesh sieve. The entire contents of the grab shall be discharged into the sieve taking care to avoid any loss of the sample.

Any material retained in the sieve (including any large shell or stone) should be transferred to a clearly labelled sealed pot.

Samples shall then be subsequently preserved using a buffered formalin (40 % formaldehyde) solution, as soon as possible after collection. Samples will be allowed to fix for a minimum of 24 hours.

4. In-feed Treatment Residues

4.1 Survey Design

The responsible person shall carry out a monitoring survey in accordance with the outlined criteria below if the in-feed treatment Emamectin Benzoate is included on the licence, and the product has been used during the cycle.

Sediment samples shall be collected for in-feed residues during the benthic monitoring survey outlined in **Section 3**.

If the benthic monitoring survey does not fall within the predicated period of the highest concentration of Emamectin Benzoate (80 - 169 days after the cessation of the last Emamectin benzoate treatment of the cycle), then an additional survey shall be carried out.

This additional survey is detailed below.



4.2 Additional In-feed Treatment Residues Survey Strategy

4.2.1 Transects

A minimum of eight sampling stations shall be monitored around each group. Of which;

- Four stations at the pen edge stations ;
- One station at the edge of the mixing zone area in both the predominant and reciprocal current direction;
- One station beyond the edge of the mixing zone area in both the predominant and reciprocal current direction.

Table 7 and 8 outline the in-feed treatment residue sampling station locations.

Table 7 South Group Additional In-feed Treatment Residues Station Locations

Transect	Bearing (deg T)	Distance (m)	Station	Easting	Northing
South Residue 1	136	0	SR1-A	199839	649348
South Residue 1	136	100	SR1-B	199909	649276
South Residue 1	136	150	SR1-C	199943	649240
South Residue 2	325	0	SR2-A	199749	649531
South Residue 2	325	100	SR2-B	199692	649611
South Residue 2	325	162.5	SR2-C	199656	649662
South Residue 3	39.6	0	SR3-A	199830	649483
South Residue 4	220.8	0	SR4-A	199757	649397

Table 8 North Group Additional In-feed Treatment Residues Station Locations

Transect	Bearing (deg T)	Distance (m)	Station	Easting	Northing
North Residue 1	334.7	0	NR1-A	199337	650041
North Residue 1	334.7	100	NR1-B	199294	650132
North Residue 1	334.7	150	NR1-C	199273	650177
North Residue 2	145.0	0	NR2-A	199487	649903
North Residue 2	145.0	100	NR2-B	199544	649821
North Residue 2	145.0	162.5	NR2-C	199580	649770
North Residue 3	64.8	0	NR3-A	199465	649995
North Residue 4	242.4	0	NR4-A	199362	649948

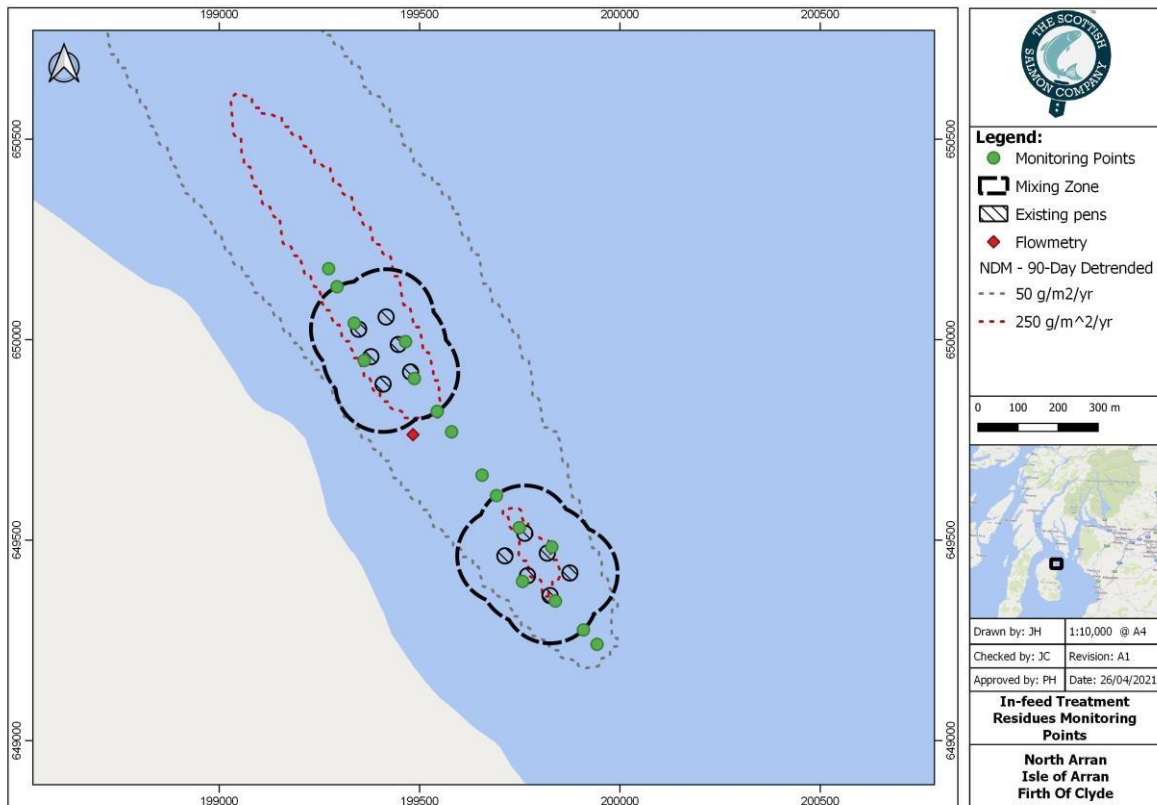


Figure 3 North Arran Additional Residue Monitoring Station Locations

4.3 Additional In-feed Treatment Residues Survey Timing

Sediment samples shall be collected between 80 and 169 days after the cessation of the last treatment in the production cycle.

If SLICE has not be used within 24 months (or the current production cycle) the survey will not be carried out.

4.4 Sampling Requirements

At each soft sediment sampling station, grab samples will be collected and analysed for the following parameters:

- Particle Size Analysis (PSA);
- Total Organic Carbon (TOC); and In-feed Treatment Residues.

The number of sample taken for each station are detailed in **Table 9 and 10** (based on collection using a 0.045 m² Van Veen grab).

**Table 9 South Group Samples per Additional In-Feed Residue Survey Station**

Station	Particle Size Analysis (PSA)	Total Organic Carbon (TOC)	In-feed Treatment Residues.
SR1-A	1	1	3
SR1-B	1	1	3
SR1-C	1	1	3
SR2-A	1	1	3
SR2-B	1	1	3
SR2-C	1	1	3
SR3-A	1	1	3
SR4-A	1	1	3

Table 10 North Group Samples per Additional In-Feed Residue Survey Station

Station	Particle Size Analysis (PSA)	Total Organic Carbon (TOC)	In-feed Treatment Residues.
NR1-A	1	1	3
NR1-B	1	1	3
NR1-C	1	1	3
NR2-A	1	1	3
NR2-B	1	1	3
NR2-C	1	1	3
NR3-A	1	1	3
NR4-A	1	1	3

Field notes will accompany samples and shall include any observation on weather conditions, position fixing problems and a visual description of sediment.

Where a sampling station is located over an area that cannot be grabbed (i.e. hard substrate habitats and /or some types of Priority Marine Features (PMF)), SEPA will be contacted to discuss further collection of visual survey footage.

4.5 Survey Protocol

4.5.1 Position Fixing

Refer to the Position Fixing section (3.6.1) above.

4.5.2 Sample Collection

At each sampling station samples shall be collected as outlined in the Sample Collection section (3.6.2). Sampling should be carried out in accordance with 'Interim Performance Standard MACSFFA-02'



4.5.3 Sample Labelling

Refer to the Sample Labelling section (3.6.3) in the Benthic Monitoring Protocol above.

4.5.4 Sediment Characterisation Total Organic Carbon (TOC)

As a minimum at each sampling location, one subsample of sediment shall be taken as a core to 5cm, and should be stored in an air tight container.

Samples shall be kept in a cool box until they can be frozen for later analysis. Samples will be frozen on the day of collection.

4.5.5 Sediment Characterisation Particle Size Analysis (PSA)

As a minimum at each sampling location, one subsample of sediment shall be collected using a corer to 5cm.

Samples shall be kept in a cool box until they can be frozen for later analysis. Samples will be frozen on the day of collection. Analysis will be by dry sieving laser granulometry.

4.5.6 In-Feed Treatment Residues

Three sediment cores shall be taken to a depth of 5 cm and kept as separate replicates.

Samples shall be kept in a glass container with a metal-foiled sealed lid.

Samples shall be kept in a cool box until they can be frozen for later analysis. Samples will be frozen on the day of collection

5. Reporting

5.1 Analytical Laboratories

All analytical laboratories shall be sufficiently accredited. Copies of all accreditations shall be supplied to SEPA prior to analysis for reference. All relevant accreditations shall also be detailed in each benthic monitoring report

5.2 Reporting

The data and supporting documents shall be reported in the Site Specific Monitoring Template.

Completed survey cover sheets shall be submitted to SEPA within 14 days of the completion of survey with confirmation of the locations of stations sampled. This shall provide the local SEPA team time to identify if the operator has sampled at incorrect locations and advise if an additional survey will be required within the sampling window. If SEPA do not contact the operator it is assumed that the sampling locations have been accepted by SEPA.



Completed benthic survey results shall be submitted to SEPA within 16 weeks of completion of the survey for sites identified as high risk, and 26 weeks for low risk sites. High-risk sites will be: those sites which have failed their benthic surveys during the past two cycles; or new sites which have not been sampled previously.