EnviroCentre

Southannan Sands SSSI Preliminary Intertidal Survey

Interim survey report

23rd April 2024

Seastar Survey Ltd. Project Number - J/24/582

For further information please contact Steven Dewey at Seastar Survey Ltd.,
Unit 1 Outlook House, Hamble Point, School Lane, Hamble, SO31 4NB
Tel: 023 8063 5000 Email: info@seastarsurvey.co.uk

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1 INTRODUCTION

1.1 Background

In order to provide evidence to support an environmental impact assessment (EIA) of the proposed redevelopment of the Hunterston construction yard, Seastar Survey Ltd. ('Seastar') was commissioned by Envirocentre to undertake an intertidal survey of the Southannan Sands site of special scientific interest (SSSI). This report details the survey methods used and describes the range and distribution of the habitats recorded within the SSSI.

1.2 Survey area

The Southannan Sands SSSI extends for approximately 4.2 km along the coast between Fairlie and Hunterston and is designated for the nationally important intertidal marine habitats saline lagoons and sandflats. The site comprises a coastal section, subdivided by Hunterston industrial developments into three discrete areas; Hunterston Sands, Southannan Sands and Fairlie Sands. The location of the SSSI is shown in Figure 1.1.

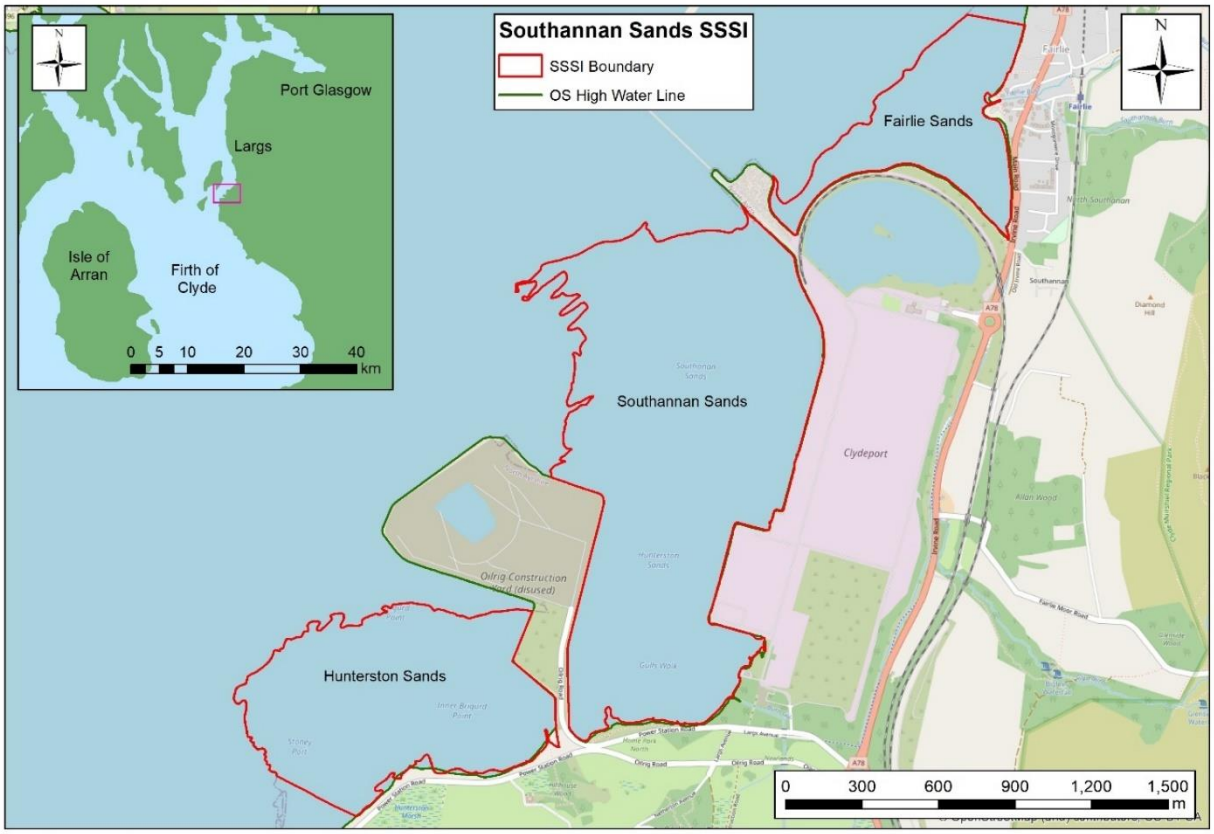

Figure 1.1: Location of Southannan Sands SSSI and the three areas of sandflat that comprise the SSSI; Hunterston Sands, Southannan Sands and Fairlie Sands.

The SSSI supports one of the best examples of intertidal sandflats habitat within the entire Clyde coastline. The sandflats are primarily composed of fine to medium sheltered sands, with a small area of mud/silt at Fairlie Sands. In addition, extensive areas of the nationally

scarce dwarf seagrass *Zostera noltei* (currently internationally accepted as the species *Nanozostera noltei*) are a biologically and structurally important component of the intertidal sediment flats at this site. Blue mussel (*Mytilus edulis*) and <Redacted>) are also known from the site, although information regarding these features is limited.

1.3 Survey aims and objectives

Common Standards Monitoring (JNCC, 2004), Water Framework Directive and OSPAR (OSPAR, 2009) guidance suggest that surveys of seagrass beds should be undertaken during the period of peak growth of seagrass, which occurs between June and September. Furthermore, due to the potentially large seasonal variations in seagrass bed extent that can occur, it is considered best practice to conduct monitoring surveys of seagrass beds during periods of peak biomass (August to September). However, due to the timescales associated with the submission of the planning permission for the proposed development, there was a requirement to undertake at least some survey work prior to the end of April 2024 to inform an assessment of likely significant effects (LSE) on the SSSI as part of the EIA. Seastar therefore suggested that a preliminary intertidal survey, comprising only rapid broadscale habitat identification and mapping techniques (i.e. Phase I survey), be undertaken in spring 2024 on the understanding that additional, more detailed and quantitative baseline survey work be conducted in the summer months. In this way, the approximate range and distribution of habitats of conservation interest, including the priority marine feature (PMF) 'seagrass beds,' could be established at an early stage.

Despite the reduced scope of the survey, the approach used was considered appropriate for the purpose of informing the planning permission submission. Where there are little to no recent habitat data available for an area (as in this case) it is considered acceptable practice to conduct Phase I surveys prior to undertaking more focused characterisation and/or baseline surveys in order to gain a better understanding of the habitats and taxa present. The broadscale habitat data acquired during the Phase I surveys can then be used to inform and better plan subsequent quantitative data collection.

The primary aim of the survey was to establish the presence and approximate distribution of particular habitats of conservation interest within the Southannan Sands SSSI, namely seagrass beds, blue mussel beds and <Redacted> The objectives of the survey were to;

- conduct a reduced-scope Phase I survey of the intertidal habitats within the SSSI;
- identify and map the approximate extent and distribution of any and all seagrass beds, blue mussel beds and <Redacted> present within the SSSI;
- identify and map the approximate extent and distribution of intertidal habitats within each subdivision of the SSSI;
- identify and map the approximate extent and distribution of the littoral biotopes present;
- characterise the habitats observed by providing a list of dominant species for each representative intertidal habitat and/or biotope;
- identify any protected species and/or communities including habitats of conservation or ecological importance such as PMFs and Annex I habitats;
- produce habitat data of sufficient resolution to enable an assessment of the LSE of the proposed development as part of the EIA.

2 METHODS

2.1 Intertidal survey

The collection and analysis of the data was completed in accordance with Common Standards Monitoring guidance (JNCC, 2004) and procedural guidelines outlined in the Marine Monitoring Handbook (Davies *et al*., 2001) and the CCW Handbook for Marine Intertidal Phase I Survey and Mapping (Wyn, *et al*., 2006).

2.1.1 Survey dates and tide times

The survey was conducted on 8th – 10th April 2024, utilising the spring tide on 9th April 2024 in order to maximise survey coverage. Due to the shallow sloping nature of the beaches in the SSSI, it was found that survey work could be undertaken up to three before and after low water. Details of the tide times are provided in Table 2.1.

Table 2.1: Tide times (UTC) and heights for Largs Yacht Haven relative to Admiralty Chart Datum (ACD) during the Southannan Sands SSSI Phase I intertidal survey. Tides utilised for survey work are highlighted in bold text.

Survey Day	Morning Low Water		Evening Low Water	
	Time	Height (m)	Time	Height (m)
Monday 08/04/2024	05:58	0.17	**18:27**	**0.38**
Tuesday 09/04/2024	**06:44**	**-0.01**	**19:12**	**-0.40**
Wednesday 10/04/2024	**07:30**	**-0.11**	19:57	-0.29

2.1.2 Survey approach

In order to better manage the survey, the SSSI was split into four survey areas; Hunterston Sands, Southannan Sands South, Southannan Sands North, and Fairlie Sands. Each of the four survey areas was visited on the morning of 8th April 2024 as part of a familiarisation process, during which the general character of the foreshore in each area was established, points of access and egress were identified, and any necessary permissions were arranged.

Prior to the survey, good quality free-to-use aerial imagery data were acquired, showing the full extent of the intertidal region of the SSSI. These data, together with the SSSI boundary, were used to create hard-copy maps of each survey area to enable wireframe annotations to be made in the field. These data were also entered into a handheld GPSMAP portable chartplotter, thereby enabling the field team to ensure that the maximum possible extent of each survey area was mapped.

2.1.3 Access

The Hunterston Sands and Southannan Sands South survey areas were accessed via laybys on Power Station Road. Permission to park in these laybys was sought from Hunterston nuclear power station security office, and the Civil Nuclear Constabulary (CNC) were informed of survey operations to avoid any potential problems.

Access to the Southannan Sands North survey area was achieved via Peel Ports Hunterston Port and Resource Centre (PARC) marine yard. Permission had to be sought to enter the yard via the gate. The field team then parked up on the road running parallel to the beach and accessed the foreshore via a narrow area of scrubland and over a disused railway line.

Access to Fairlie Sands was achieved via Fairle Viewpoint carpark off of the Largs to Irvine Road.

2.1.4 Habitat assessment

Each survey area was surveyed using a different low tide. For each area, a general route was planned to maximise the area surveyed in as safe a manner as possible. The route followed the ebbing tide down the beach and the flooding tide back up, ensuring that the lowest part of the shore was surveyed at and around the time of low water. A team of two field scientists conducted the survey walking parallel to each other at a distance of approximately 70 – 80 m to enable greater survey coverage.

GPS data were recorded throughout the survey using a GPSMAP portable chartplotter, which used both GPS and GLONASS sensors for improved positional accuracy. The aerial photography and SSSI boundary data imported to the chartplotter were referred to frequently throughout the survey, in order to ensure that good coverage of each survey area was achieved.

Within each survey area, the habitat types observed were identified and assigned a biotope as per the latest iteration of the MNCR Marine Habitat Classification for Britain and Ireland (JNCC, 2022), incorporating information regarding species composition and abundance, shore height, exposure of the shore and substrate type. Generally, the position and dimensions of each habitat were captured using detailed wireframe map annotations and field sketches, however where target habitats (i.e. seagrass beds and blue mussel beds) were encountered, these were mapped using the track function in the portable chartplotter wherever possible. For smaller habitats, approximate dimensions were also recorded.

For each identified habitat, a brief habitat description was recorded using modified MNCR field forms (see Appendix I), including information regarding shore position, substrate type and percentage cover, rock type, surface relief, texture and stability, modifiers such as scour, silt and macroalgal mats, and any anthropogenic influences present. In addition, for each identified habitat, a list of the dominant/conspicuous biota present was produced with taxa enumerated using the semi-quantitative SACFOR[1] scale (see Appendix II). Any additional relevant metadata, including time, state of tide, weather etc., were also recorded.

[1] **S**uper-abundant, **A**bundant, **C**ommon, **F**requent, **O**ccasional, **R**are.

Photographs and videos documenting each observed habitat were captured throughout the survey. The GPS position of each video and photograph was also recorded.

Where target features of conservation interest were identified, additional data were recorded. Where seagrass was present, the species and overall estimated percentage cover were recorded, and any observations relating to seagrass health (e.g. browning, presence of epiphytes) were also noted. Where blue mussel beds were encountered, the species, density, and the most common individual size class(es) were recorded. Where hard substrate was encountered, an assessment of 'reefiness' was conducted, as per Irving (2009), recording the type, elevation, composition and extent of potential reef features.

2.1.5 Additional observations

Throughout the survey, any non-indigenous species (NIS), freshwater outflows, litter or other anthropogenic influences were documented. In each instance, the position was recorded from the GPS and a photograph was taken. Where anthropogenic influences were clearly impacting the surrounding environment, details of this were recorded. Where NIS were encountered, abundance was recorded using the semi-quantitative SACFOR scale.

2.1.6 Analysis

All field notes, including field sketches, were digitised post-survey and photographic records were reviewed by a senior marine ecologist to confirm the assigned biotopes and taxon identifications. Species lists were created for each Phase I habitat ensuring that all taxa were recorded in accordance with the World Register of Marine Species (WoRMS Editorial Board, 2024) and assigned an MCS alphanumeric bio-code according to Howson and Picton (1997), where applicable, to avoid problems in species nomenclature. Biotopes were assigned to each habitat according to the Marine Habitat Classification for Britain and Ireland (JNCC, 2022).

2.1.7 GIS

Data obtained during the Phase I survey, included all GPS trackplots and relevant point data, were imported into ArcGIS. Utilising these data together with the wireframe map field sketches created during the Phase I surveys, polygons were created within the GIS in order to map the location of the different biotopes identified within each of the four survey areas.

3 RESULTS

All areas of the Southannan Sands SSSI were successfully surveyed. The intertidal survey logs, including details of the habitats and taxa recorded, are provided in Appendix III and IV. The range and distribution of habitats in each area is described in the following sections. A glossary of the biotopes recorded during the survey is provided in Appendix V.

3.1 Hunterston Sands

The distribution of identified biotopes at Hunterston Sands is shown in Figure 3.1. The upper shore at Hunterston Sands was composed of a narrow band of barren sand (**LS.LSa.St**; 'Strandline'), followed by a band of pebbles and sand with little to no biota (**LS.LCS.Sh.BarSh**; 'Barren littoral shingle'). Below this was a large zone of rippled medium to fine sand with occasional pebbles and cobbles that covered most of the eastern half of the area. The northern half of this zone was fairly barren and was therefore assigned the biotope complex **LS.LSa.FiSa** ('Polychaete/amphipod-dominated fine sand shores'), however in the southern half of this area patchy/sparse *Zostera noltei* was present. Despite the low percentage cover of seagrass (~5 %), the biotope **LS.LMp.LSgr.Znol** ('*Zostera noltei* beds in littoral muddy sand') was assigned to this area.

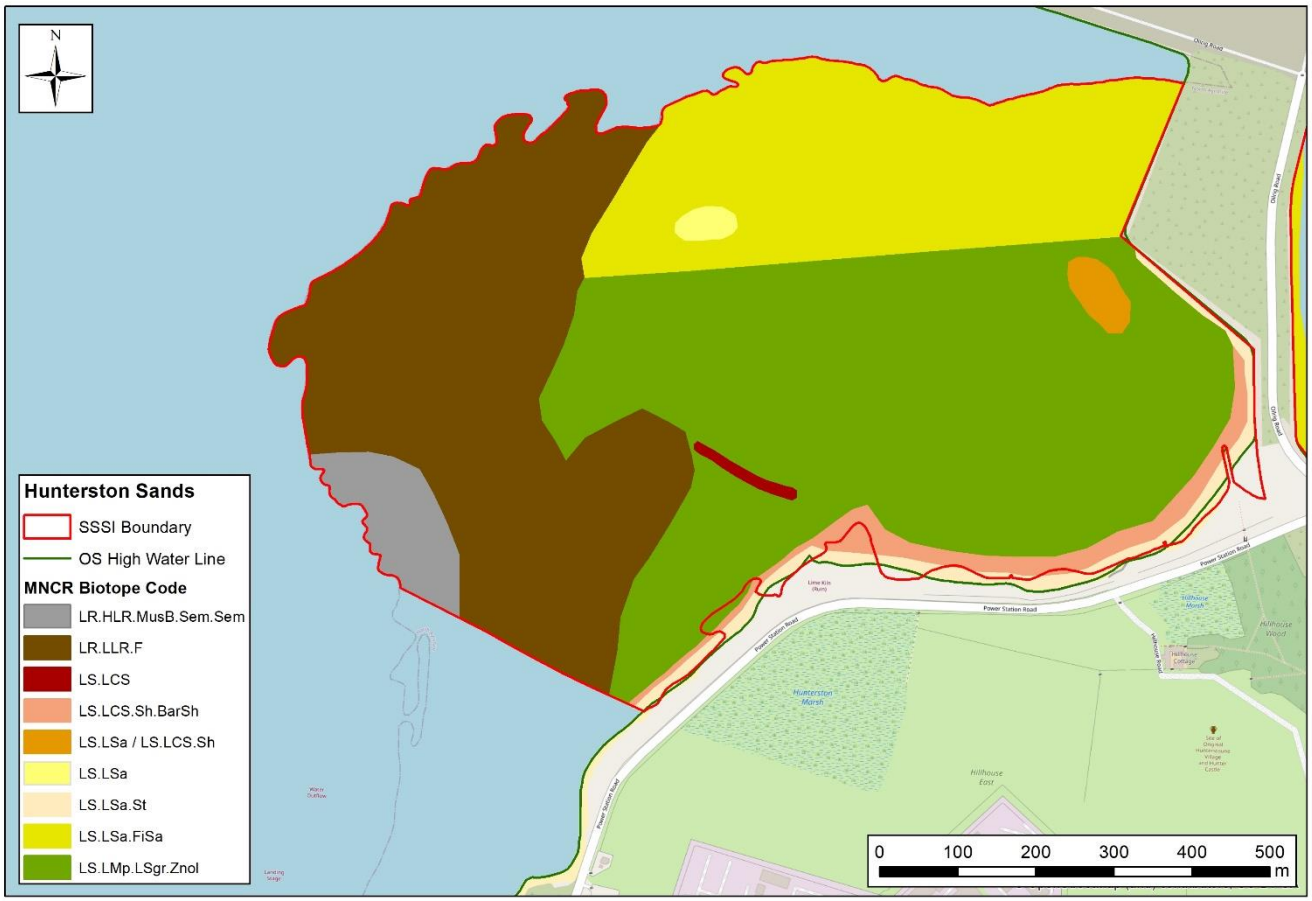

Figure 3.1: Distribution of the biotopes identified in the Hunterston Sands survey area during the preliminary Phase I survey of Southannan Sands SSSI.

The western half of Hunterston Sands was rather different to the east, being characterised by a mixture of pebbles, cobbles and boulders overlying firm sand. Fucoid-dominated communities typical of sheltered shores were present across the majority of this area. Vertical zonation was apparent in the relative abundance of different fucoid species, including *Pelvetia canaliculata* (high shore), *Fucus vesiculosus* (mid shore) and *F. serratus* (low shore). It is therefore likely that this zone housed a range of biotopes, including **LR.LLR.F.Pel** ('*Pelvetia canaliculata* on sheltered littoral fringe rock'), **LR.LLR.F.Fves.X** ('*Fucus vesiculosus* on mid eulittoral mixed substrata') and **LR.LLR.F.Fserr.X** ('*Fucus serratus* on full salinity lower eulittoral mixed substrata'), however the boundaries between these biotopes could not be accurately mapped due to a lack of available time; the biotope complex **LR.LLR.F** ('Fucoids on sheltered marine shores') was therefore assigned to the entirety of this zone.

At the far western edge of Hunterston Sands an area of cobbles and small boulders was present, characterised by common *Semibalanus balanoides* together with occasional limpets (*Patella* sp.) and occasional common periwinkles (*Littorina littorea*). The biotope **LR.HLR.MusB.Sem.Sem** ('*Semibalanus balanoides*, *Patella vulgata* and *Littorina* spp. on exposed to moderately exposed or vertical sheltered eulittoral rock') was therefore recorded.

3.2 Southannan Sands

The distribution of identified biotopes at Southannan Sands is shown in Figure 3.2. The northern section of Southannan Sands was primarily composed of rippled medium to fine sand with shell fragments (**LS.LSa**; 'Littoral sand') with small (<25 m^2) patches of cobbles on which a range of taxa, including juvenile fucoids, *S. balanoides*, *Patella* sp., *L. littorea* and the dog whelk *Nucella lapillus*, were present. Where worm casts were present, the biotope **LS.LSa.FiSa.Po** ('Polychaetes in littoral fine sand') was recorded. A small patch of basalt rock was observed in the upper shore region on which vertical zonation was visible, however due to the small size of the vertical bands, individual biotopes could not be assigned. The rock was therefore assigned at the biotope complex level (**LR.LLR.F**).

A relatively small area of *Z. noltei* seagrass bed was also present in this area, covering approximately 4.13 ha, although, as at Hunterston Sands, seagrass coverage was low (~10 %). While the substrate was predominatantly composed of rippled medium to fine sand, patches of cobbles and pebbles were present within this zone, featuring a mixture of *Fucus spiralis* and *F. vesiculosus*.

In the approximate centre of the Southannan Sands area, freshwater inputs were present which appeared to be affecting the habitats and communities present. Around one of these freshwater inputs an area of slightly silty medium to fine sand was present with dense worm casts and a brown algal mat on the sediment surface (**LS.LSa.MuSa**; 'Polychaete/bivalve-dominated muddy sand shores'). Shoreward of this, around a second freshwater input, an area of rippled fine sand with dense *Lanice conchilega* (**LS.LSa.MuSa.Lan**; '*Lanice conchilega* in littoral sand') was present. Between these two areas, sediments were mixed, comprising pebbles, cobbles and shell overlying soft muddy sands (**LS.LMx**; 'Littoral mixed sediment'). This included an area that appeared to be a dead mussel bed (recorded as **LS.LMx (variant)**); *Mytilus edulis* shells were present attached to the substrate, however these were generally covered in keel worms (*Spirobranchus* sp.) and barnacles and no live examples were observed. To the south of this area, however, a patchy living *M. edulis* mussel bed was present (**LS.LBR.LMus.Myt.Mx**; 'Mussels on mixed sediment').

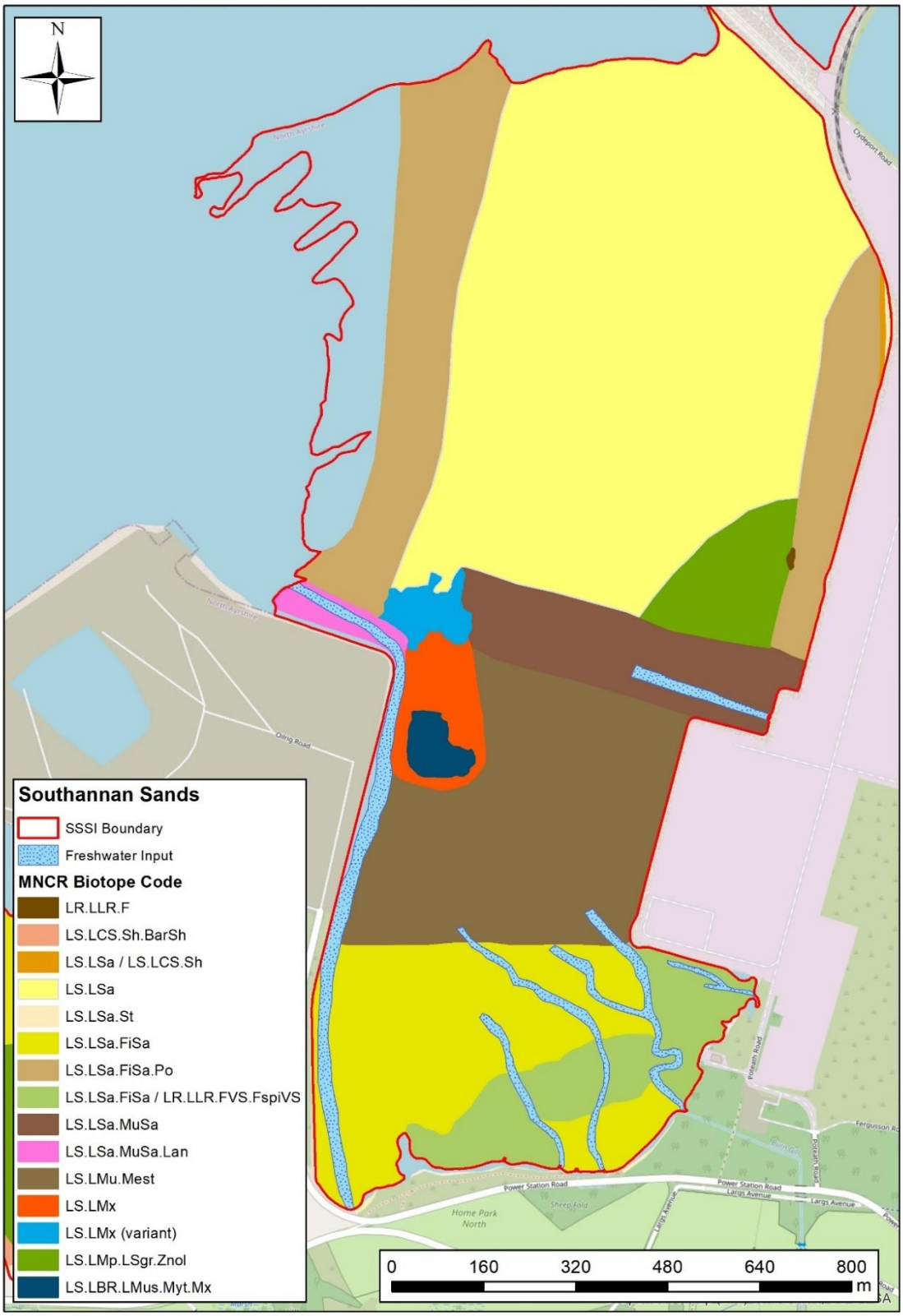

Figure 3.2: Distribution of the biotopes identified in the Southannan Sands survey area during the preliminary Phase I survey of Southannan Sands SSSI.

The southern section of Southannan Sands was heavily influenced by freshwater inputs and was primarily composed of either muddy fine sands (**LS.LSa.FiSa**) or soft sandy muds (**LS.LMu.Mest**; 'Polychaete/bivalve-dominated mid estuarine mud shores'). Adjacent to the freshwater inputs, however, patches of ephemeral algae, including *Ulva intestinalis* and a brown algal mat, were present on muddy sand (**LS.LSa.MuSa**). Areas of the wracks *F. spiralis* and *P. canaliculata* on cobbles overlying sand (**LR.LLR.FVS.FspiVS**; '*Fucus spiralis* on sheltered variable salinity upper eulittoral rock') were also present in this area.

3.3 Fairlie Sands

The distribution of identified biotopes at Fairlie Sands is shown in Figure 3.3.

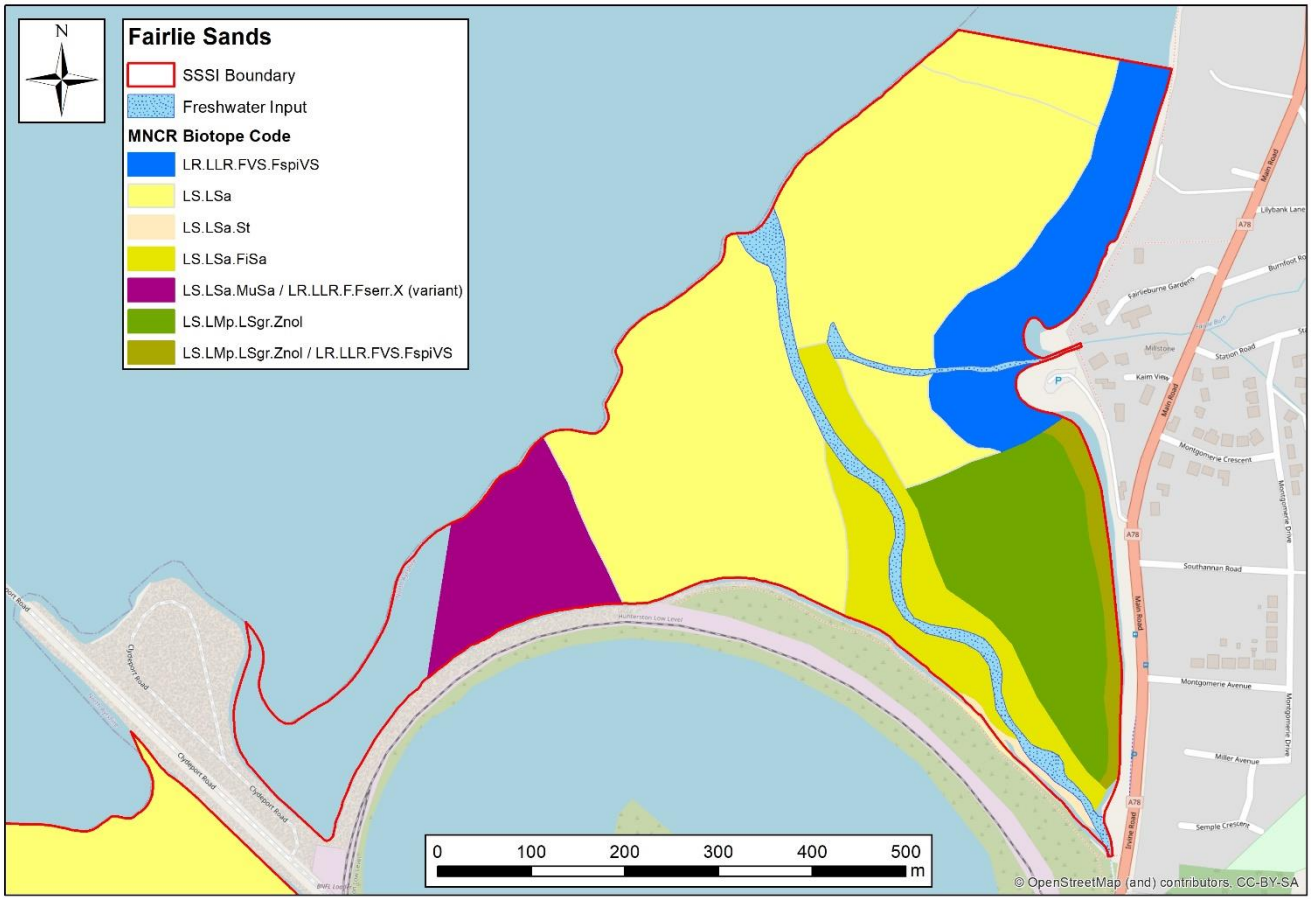

Figure 3.3: Distribution of the biotopes identified in the Fairlie Sands survey area during the preliminary Phase I survey of Southannan Sands SSSI.

The foreshore at Fairlie Sands primarily consisted of a shallow sloping sandflat which was affected by multiple anthropogenic factors. The majority of the area was characterised by rippled medium to fine sands with broken shell and occasional pebbles (**LS.LSa**), however in the south-westernmost corner of the Fairlie Sands a Pacific oyster (*Magallana gigas*) farm was present. This was in use at the time of survey and was not accessed by the survey team, however adjacent to the existing farm was an area of disused oyster farm nets which ran vertically down the shore. The sediment here was significantly more muddy than in the rest of Fairlie Sands (**LS.LSa.MuSa**). In addition, the disused nets were densely colonised by a range of macroalgae, particularly *F. serratus* and the kelp *Saccharina latissima*. Whilst the

presence of artificial substrate means that assignment of biotopes to this area is problematic, the very high density of *F. serratus* (which appeared to entirely cover the sediment in places) was sufficient that a variant of the biotope **LR.LLR.F.Fserr.X (artificial substrate)** was also recorded for this area.

Two major freshwater inputs were identified at Fairlie Sands. The larger of these was a brook that ran approximately southeast to northwest, bisecting the area. This freshwater input appeared to be affecting the habitat, with abundant worm casts and burrows (~60-80 m^{-2}) observed either side of the brook (**LS.LSa.FiSa**). A second, smaller freshwater input was identified running east to west in the approximate centre of Fairlie Sands. Between the two freshwater inputs, and bounded by land on the eastern side, a *Z. noltei* seagrass bed (**LS.LMp.LSgr.Znol**) was identified. While the sediment in this area was primarily composed of rippled fine sand, cobbles were also present on which dense stands of the wrack *F. spiralis* was present; these cobbles were significantly more common (~30 % coverage) along the landward edge of the seagrass bed, where the biotope **LR.LLR.FVS.FspiVS** was recorded in addition to **LS.LMp.LSgr.Znol**. The biotope **LR.LLR.FVS.FspiVS** was also recorded in the upper shore in the northern half of Fairlie Sands.

3.4 Non-indigenous species

One NIS was identified during the survey; Japanese wireweed, *Sargassum muticum*, an invasive species originating from the Pacific and which first appeared in the UK on the Isle of Wight in 1973 (Pizzolla, 2008), was observed attached to hard substrate at both Southannan Sands North and Hunterston Sands in the low shore, where it was recorded as rare. In addition, however, significantly larger quantities of *S. muticum* were present as phytodetritus, washed in by the tide. It is therefore likely that this species is present in higher abundances in the subtidal offshore of the SSSI.

Despite the presence of the oyster farm at Fairlie Sands, no escaped *M. gigas* were observed within the survey area.

4 DISCUSSION

4.1 Survey summary

Due to the extreme low tides that occurred during the survey of Southannan Sands SSSI, excellent coverage was achieved and all areas were successfully mapped. A total of 18 biotopes, including variants, were identified, and two of the three target features of conservation interest, seagrass beds and blue mussel beds, were recorded.

4.2 Features of conservation interest

The distribution of the observed target features of interest, i.e. seagrass beds and blue mussel beds, is shown in Figure 4.1. It should be noted that the boundaries of the seagrass beds were not accurately mapped due to time constraints; the mussel bed, however, was mapped using the trackplot function of the portable chartplotter and is therefore very accurate.

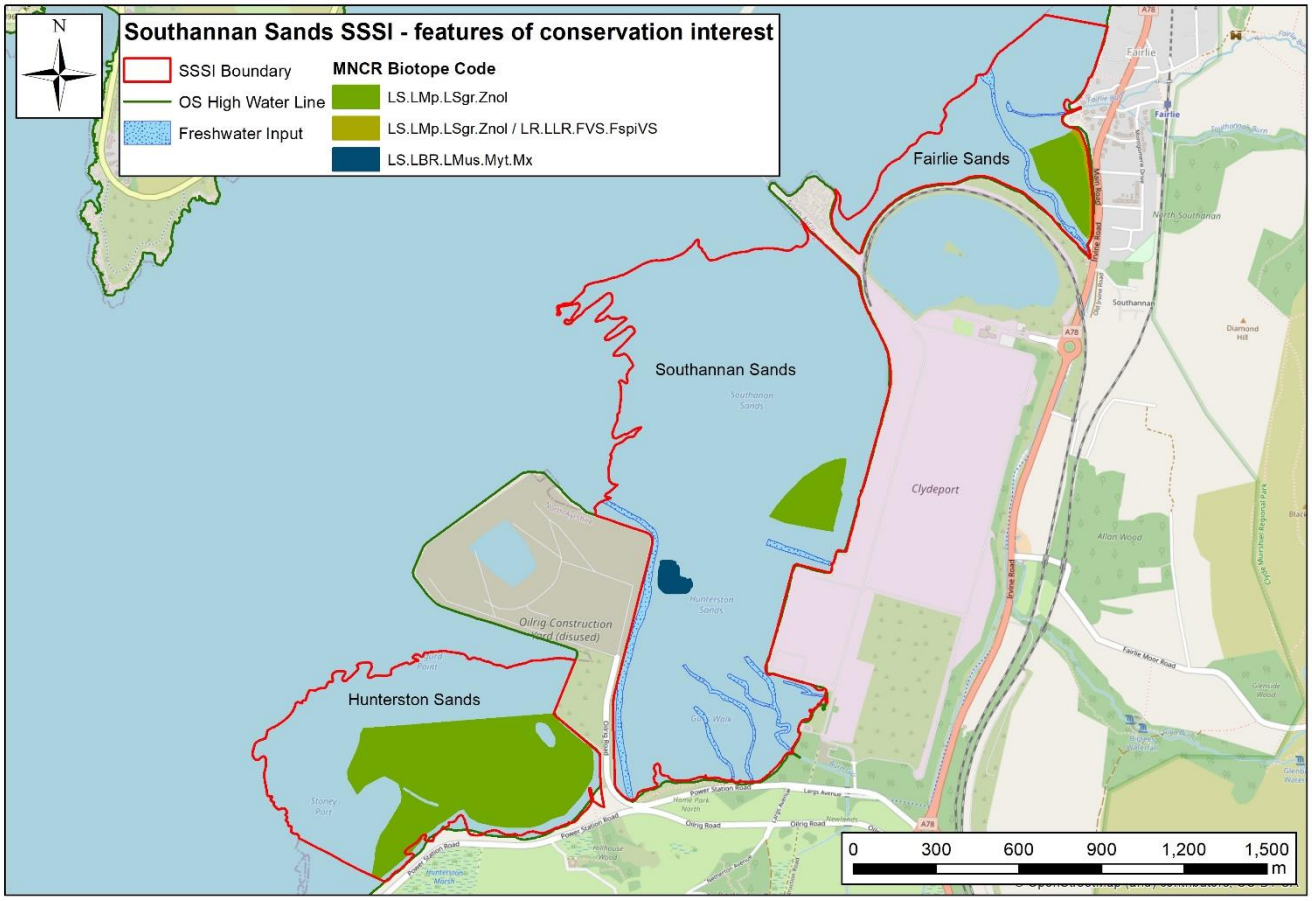

Figure 4.1: Distribution of the features of conservation interest (seagrass beds and mussel beds) identified during the preliminary Phase I survey of Southannan Sands.

The seagrass beds identified during the survey covered a total area of approximately 38.04 ha and were recorded in all three subdivisions of the SSSI. All beds comprised *Z. noltei* only (**LS.LMp.LSgr.Znol**). The largest bed was recorded at Hunterston Sands (29.13 ha), however

estimated seagrass density was highest in the bed identified at Fairlie Sands (~30 % coverage).

A single blue mussel bed (**LS.LBR.LMus.Myt.Mx**) was identified during the survey. This bed was located in the approximate centre of Southannan Sands on mixed sediment and covered an area of approximately 1.04 ha. Mussels were generally present as clumps rather than as a contiguous bed, and commonly measured between 3 and 5 cm in length. In addition to this bed, an area of dead mussel bed was also recorded at Southannan Sands, just to the north of the extant bed. In sheltered conditions, such as those present at Southannan Sands, mussel beds are known to be a potentially transient feature; in sheltered conditions, mussel pseudofaeces may build up over time, creating a layer of mud which may prevent additional attachment, making the mussel bed unstable and liable to be washed away during storms (Connor *et al*., 2004). However, given that the mussel shells were still present and bound by byssus threads to the surrounding sediment, it is also possible that the death of this bed was caused by other factors, such as a smothering event or prolonged high temperatures.

With the exception of those being harvested at the oyster farm, no oysters, native or otherwise, were observed during the survey, although two empty *M. gigas* shells were found, likely washed in by the tide from the oyster farm. However, according to one of the workers at the oyster farm, who spoke with the field team during the survey at Fairlie Sands, <Redacted> have been known to grow within the oyster farm nets. There remains, therefore, the possibility that <Redacted> are present within the SSSI.

Both seagrass beds and blue mussel beds are PMFs (Tyler-Walters *et al*., 2016); the PMF 'intertidal mudflats' was also identified in the southern section of Southannan Sands (biotope **LS.LMu.Mest**). This habitat could not be safely traversed by the field team as the sediment was very soft, however the biotope was estimated to cover an area of approximately 20 ha.

While hard substrate was recorded during the survey, none of the areas of rock and stony ground observed were connected to subtidal reefs, and therefore did not qualify as Annex I habitats.

4.2.1 Presence of SSSI habitats

Two biotopes considered nationally or internationally important (as listed in Annex I of Brazier *et al*., 2019) were recorded during the survey. These were the seagrass biotope **LS.LMp.LSgr.Znol** and the muddy gravel broad habitat type **LS.LMx**, which was recorded in the central region of Southannan Sands, and included the area of dead mussel bed, which was recorded as a variant of this biotope. In addition, both blue mussel beds and seagrass beds are listed as habitats of interest in Great Britain (as listed in Annex II of Brazier *et al*., 2019).

A summary of the biotopes identified that are typical of each of the whole shore types that should be represented in the SSSI series, as listed in Annex III of Brazier *et al*. (2019), is shown in Table 4.1. The biotopes recorded were generally typical of sheltered soft sediment shores, with coarse sediments, sands and muddy sands, muds, and mixed sediments all represented. In addition, where hard substrate biotopes were present, these were generally typical of wave-sheltered rock and/or mixed substrate shores.

Table 4.1: Biotopes identified during the Southannan Sands SSSI preliminary intertidal survey that are typical of each of the whole shore types that should be represented in the SSSI series. Adapted from Brazier *et al.* (2019).

Biotope	Wave sheltered rock	Mixed substrate	Sand and coarse sediment	Sand and muddy sand	Mud	Mixed sediment
LR.LLR.F*	●	●				
LS.LCS.Sh.BarSh			●			
LS.LSa.FiSa.Po			●	●		
LS.LSa.MuSa.Lan				●		
LS.LMu.Mest					●	
LS.LMx						●
LS.LBR.LMus.Myt.Mx		●				
LS.LMp.LSgr.Znol				●	●	

*whilst the habitats observed were often recorded at the biotope complex level due to time constraints, several potential biotopes and sub-biotopes within this complex were noted that are listed in Annex III of Brazier *et al*. (2019).

4.3 Limitations

Due to the timings associated with the submission of the planning permission, there was a requirement to undertake the survey in spring 2024. Common Standards Monitoring (JNCC, 2004), Water Framework Directive and OSPAR (OSPAR, 2009) guidance suggest that surveys of seagrass beds should be undertaken during the period of peak growth and/or biomass of seagrass (June – September). Working on the assumption that additional, more detailed survey work will be conducted in the summer months, the survey work conducted in April 2024 aimed only to establish the approximate range and distribution of intertidal habitats present in the SSSI, focusing on seagrass beds and blue mussel beds, and was not designed to yield quantitative baseline data against which potential future change can be measured. Furthermore, due to time constraints, the boundaries of the different habitats could not be mapped in detail and the boundary positions shown on the habitat maps in this report are approximate, with the exception of smaller target features of conservation interest, i.e. the blue mussel bed in Southannan Sands. The habitat maps and results data presented in this report should therefore be considered preliminary findings only.

4.4 Report summary and recommendations

The survey detailed in this report achieved all of the stated objectives, and the data collected were deemed to be sufficient for the purpose of informing the EIA and enabling assessments of the LSE associated with the proposed development. Despite the reduction in scope, the survey approach was deemed appropriate for the project, as the data acquired were of sufficient resolution to gain a good understanding of the range and distribution of habitats, biotopes and dominant taxa in the SSSI. Furthermore, the data acquired can be used to inform subsequent surveys, including baseline and monitoring surveys.

It is strongly recommended that a full baseline survey is carried out prior to commencement of the proposed development. The data collected should be of sufficient quality and resolution to be suitable in supporting future assessments of feature condition and of measuring the

magnitude and direction of any potential change related to the proposed development. A marine monitoring plan (MMP) should be developed by personnel familiar with such surveys in conjunction with the regulators and with relevant local stakeholder groups and specialists, where available.

It is recommended that baseline surveys should include Phase II intertidal surveys to collect quantitative, statistically robust species data, particularly with regard to metrics for assessment of seagrass beds, such as shoot density, shoot length and epiphytic cover. It is strongly recommended that these surveys are conducted in late summer (ideally August) when seagrass and macroalgal growth/biomass is at maximum and spring low tides can be utilised for intertidal survey.

All baseline surveys should be conducted with reference to the habitat mapping data presented in this report and should aim to build upon the data collected using readily comparable methodologies. Suitable control sites should also be identified, and a suitable monitoring programme developed.

5 REFERENCES

This report to be cited as:

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6 APPENDICES

Appendix I: Modified MNCR field form used as part of the preliminary intertidal survey of Southannan Sands SSSI.

Intertidal Ecological Surveys - Phase I recording form (one per habitat) 1) Site information					
Date:		**Time/weather/state of tide/other data:**			
Habitat no.:		**GPS trackplot info:**			
Shore position (circle appropriate):	**Strandline**	**High**		**Mid**	**Low**
Position:		**N**			**W**
Position notes: (include type)					

2) Detailed habitat description. Include abiotic and biotic factors.

3) Note if the following are present:	Tick as appropriate
Burrows / holes	
Tubes	
Algal mat	
Drainage channels / creeks / freshwater runoff	
Standing water	
Sediment veneer	
Sabellaria alveolata (detail below)	
Mussels/oysters (deatil below)	
Seagrass (detail below)	
Anthropogenic feature (detail below)	
Rockpools	
Other (please specify)	

Substrate Type	% cover (approx.)
Bedrock	
Boulders (S/L/XL)	
Cobbles	
Pebbles	
Gravel	
Shell / shell gravel	
Sand	
Mud	
Mussel bed	
Biogenic (specify)	
Artificial (specify)	
Peat/clay (specify)	

4) Major taxa present (Please note species below with SACFOR abundance)

5) MNCR Biotope code / notes (e.g. variant)

6) Assessment of features of conservation interest				
Habitat type (circle)	**Rocky reef**	**Stony reef**	**Mussel/oyster beds**	**Seagrass bed**
Reefiness (N/L/M/H)	**Elevation:**	**Composition:**	**Extent:**	
Mussels/oysters	**Species:**	**Density:**	**Size:**	
Seagrass	**Species:**	**Density:**	**Health:**	

7) Additional notes (e.g. habitat condition, rock type, anthropogenic impacts etc.)

Appendix II: MNCR SACFOR abundance scale.

The MNCR cover/density scales adopted from 1990 onwards (see Hiscock, 1996) provide a unified system for recording the abundance of marine benthic taxa in intertidal and subtidal marine surveys. The scales are given below.

MNCR SACFOR abundance scales

S = Superabundant, A = Abundant, C = Common, F = Frequent, O = Occasional, R = Rare

GROWTH FORM			SIZE OF INDIVIDUALS / COLONIES				
% COVER	CRUST / MEADOW	MASSIVE / TURF	<1 cm	1-3 cm	3-15 cm	>15 cm	DENSITY
>80%	S		S				>1 / 0.0001 m^2 (1x1 cm) >10,000/ m^2
40-79%	A	S	A	S			1-9 / 0.001 m^2 (3.16x3.16 cm) 1000-9999 / m^2
20-39%	C	A	C	A	S		1-9 / 0.01 m^2 (10x10 cm) 100-999 / m^2
10-19%	F	C	F	C	A	S	1-9 / 0.1 m^2 10-99 / m^2
5-9%	O	F	O	F	C	A	1-9 / m^2
1-5% or density	R	O	R	O	F	C	1-9 / 10 m^2 (3.16x3.16 m)
<1% or density		R		R	O	F	1-9 / 100 m^2 (10x10 m)
					R	O	1-9 / 1000 m^2 (31.6x31.6 m)
						R	>1 / 10,000 m^2 (100x100 m) <1 / 1000 m^2

PORIFERA	Crusts *Halichondria*	Massive spp. *Pachymatisma*		Small solitary *Grantia*	Large solitary *Stelligera*	
HYDROZOA		Turf species *Tubularia Abietinaria*		Small clumps *Sarzia Aglaophenia*	Solitary *Corymorpha Nemertesia*	
ANTHOZOA	*Corynactis*	*Alcyonium*		Small solitary *Epizoanthus Caryophyllia*	Med. Solitary *Virgularia Cerianthus Urticina*	Large solitary *Eunicella Funiculina Pachycerianthus*
ANNELIDA	*Sabellaria spinulosa*	*Sabellaria alveolata*	*Spirorbis*	Scale worms *Nephtys Pomatoceros*	*Chaetopterus Arenicola Sabella*	
CRUSTACEA	Barnacles Tubiculous amphipods		*Semibalanus* Amphipods	*B. balanus Anapagurus Pisidia*	*Pagurus Galathea* Small crabs	*Homarus Nephrops Hyas araneus*
MOLLUSCA	*Mytilus Modiolus*		Small gastropod *L. neritoides* Small bivalves *Nucula*	Chitons Med. gastropod *L. littorea Patella* Med. bivalves *Mytilus Pododesmus*	Large gastropod *Buccinum* Lge bivalves *Mya, Pecten Arctica*	
BRACHIOPODA				*Neocrania*		
BRYOZOA	Crusts	*Pentapora Bugula Flustra*			*Alcyonidium Porella*	
ECHINO-DERMATA				*Echinocyamus Ocnus*	*Antedon* Small starfish Brittlestars *Echinocardium Asilia, Thyone*	Large starfish *Echinus Holothuria*
ASCIDIACEA	Colonial *Dendrodoa*			Small solitary *Dendrodoa*	Large solitary *Ascidia, Ciona*	*Diazona*
PISCES					Gobies Blennies	Dog fish Wrasse
PLANTS	Crusts, Maerl *Audouinella* Fucoids, Kelp *Desmarestia*	Foliose Filamentous			*Zostera*	Kelp *Halidrys Chorda Himanthalia*

Examples of groups or species for each category

Appendix III: A summary of the survey logs for work conducted during the preliminary intertidal survey of Southannan Sands SSSI.

Survey Area	Date	Habitat Number	Shore Position	Habitat Description	MNCR Biotope Code
Southannan Sands North	08/04/2024	S01	High	Barren medium sand.	LS.LSa.St
Southannan Sands North	08/04/2024	S02	High	Empty shells and shell fragments overlying medium sand.	LS.LSa / LS.LCS.Sh
Southannan Sands North	08/04/2024	S03	High	Occasional worm casts in rippled medium sand with empty shells and shell fragments.	LS.LSa.FiSa.Po
Southannan Sands North	08/04/2024	S04	High	Basalt bedrock outcrop with ephemeral green algae, lichens, wracks and barnacles.	LR.LLR.F
Southannan Sands North	08/04/2024	S05	Mid	Rippled medium to fine sand with shell fragments and small patches of cobbles with fucoids and periwinkles.	LS.LSa
Southannan Sands North	08/04/2024	S06	Mid	Rippled medium to fine sand and shell fragments with small patches of cobbles and pebbles.	LS.LMp.LSgr.Znol
Southannan Sands North	08/04/2024	S07	High - Mid	Freshwater influenced slightly silty medium to fine sand with dense worm casts and brown algal mat.	LS.LSa.MuSa
Southannan Sands North	08/04/2024	S08	Low	Occasional worm casts in rippled medium/fine sand and shell fragments with algal mat.	LS.LSa.FiSa.Po
Southannan Sands North	08/04/2024	S09	Low	*Lanice conchilega* in rippled medium/fine sand with shell fragments.	LS.LSa.MuSa.Lan
Southannan Sands North	08/04/2024	S10	Low	Empty mussel shells and shell fragments overlying very soft fine sand and mud.	LS.LMx (variant)
Southannan Sands North	08/04/2024	S11	Low	Mixed broken shell, pebbles and gravel overlying soft muddy sand.	LS.LMx
Southannan Sands North	08/04/2024	S12	Mid	Small clumps of large mussels on shell fragments and empty shells overlying soft fine sand and mud.	LS.LBR.LMus.Myt.Mx
Southannan Sands South	09/04/2024	S13	Mid	Sandy mud with burrows and ephemeral green algae.	LS.LMu.Mest

Survey Area	Date	Habitat Number	Shore Position	Habitat Description	MNCR Biotope Code
Southannan Sands South	09/04/2024	S14	Mid	Muddy fine sand with burrows and ephemeral green algae including *Ulva intestinalis*.	LS.LSa.MuSa
Southannan Sands South	09/04/2024	S15	High	Moderately sorted slightly muddy fine sand with burrows and worm casts.	LS.LSa.FiSa
Southannan Sands South	09/04/2024	S16	High	Rippled fine sand with overlying cobbles with *Fucus spiralis* and *Pelvetia canaliculata*.	LS.LSa.FiSa / LR.LLR.FVS.FspiVS
Hunterston Sands	09/04/2024	H01	High	Barren medium sand at strandline.	LS.LSa.St
Hunterston Sands	09/04/2024	H02	High	Barren shingle.	LS.LCS.Sh.BarSh
Hunterston Sands	09/04/2024	H03	Mid	Patchy, sparse seagrass bed on rippled fine to medium sand with occasional cobbles.	LS.LMp.LSgr.Znol
Hunterston Sands	09/04/2024	H04	High - Low	Rippled fine to medium sand with occasional cobbles overlying.	LS.LSa.FiSa
Hunterston Sands	09/04/2024	H05	Mid	Rippled coarse sand, gravel, pebbles and cobbles with sparse fucoids, periwinkles and barnacles.	LS.LSa
Hunterston Sands	09/04/2024	H06	Mid	Coarse sand, gravel and pebbles with sparse/patchy periwinkles and barnacles.	LS.LSa / LS.LCS.Sh
Hunterston Sands	09/04/2024	H07	Mid	Coarse sand, gravel, pebbles and cobbles with sparse biota.	LS.LCS
Hunterston Sands	09/04/2024	H08	Low	Mixed fucoids on cobbles, boulders and pebbles on firm sand with barnacles, limpets and periwinkles.	LR.LLR.F
Hunterston Sands	09/04/2024	H09	Low	Barnacles on cobbles and small boulders with limpets and periwinkles.	LR.HLR.MusB.Sem.Sem
Fairlie Sands	10/04/2024	F01	High	Freshwater influenced cobbles, pebbles and gravel with *Fucus spiralis* and *Pelvetia canaliculata*.	LR.LLR.FVS.FspiVS
Fairlie Sands	10/04/2024	F02	High	Patchy/sparse seagrass beds on rippled sand and broken shell with overlying cobbles and pebbles with dense *Fucus spiralis*.	LS.LMp.LSgr.Znol / LR.LLR.FVS.FspiVS

Survey Area	Date	Habitat Number	Shore Position	Habitat Description	MNCR Biotope Code
Fairlie Sands	10/04/2024	F03	High - Mid	Seagrass beds on rippled fine sand with occasional cobbles and *Fucus spiralis*.	LS.LMp.LSgr.Znol
Fairlie Sands	10/04/2024	F04	Mid	Rippled slightly muddy sand with abundant worm casts and burrows.	LS.LSa.FiSa
Fairlie Sands	10/04/2024	F05	Low	Medium rippled sand with occasional pebbles and old oyster farm bags/nets with *Fucus serratus* and *Saccharina latissima* attached.	LS.LSa.MuSa / LR.LLR.F.Fserr.X (variant)
Fairlie Sands	10/04/2024	F06	Low	Rippled medium/fine sand with occasional pebbles and empty shells / shell fragments.	LS.LSa
Fairlie Sands	10/04/2024	F07	Low	Rippled medium sand with sparse algal mat and sparse/patchy cobbles and pebbles.	LS.LSa

Appendix IV: Species lists for each habitat recorded as part of the preliminary intertidal survey of Southannan Sands SSSI.

Survey Area	Southannan Sands North	Southannan Sands North	Southannan Sands North	Southannan Sands North	Southannan Sands North	Southannan Sands North
Habitat No.	S01	S02	S03	S04	S05	S06
Shore Position	High	High	High	High	Mid	Mid

Taxon	Qualifier	SACFOR class						
Caloplaca	sp.	crust/meadow				F		
Lanice conchilega		1 - 3 cm						
Spirobranchus	sp.	crust/meadow						
Semibalanus balanoides		crust/meadow				C	R	R
Patella	sp.	3 - 15 cm				O	R	R
Littorina littorea		1 - 3 cm			R	R	R	R
Littorina saxatilis		1 - 3 cm						
Melarhaphe neritoides		<1 cm						
Nucella lapillus		1 - 3 cm					R	R
Mytilus edulis		3 - 15 cm						
Rhodophyta	filamentous	massive/turf						
Porphyra	sp.	massive/turf						
Corallinaceae	indet. calcareous crusts	crust/meadow						
Phaeophyceae	filamentous	massive/turf						
Phaeophyceae	filiform, mat forming	massive/turf						
Saccharina latissima		crust/meadow						
Ascophyllum nodosum		crust/meadow				O		
Fucus	sp. indet.	crust/meadow					R	R
Fucus serratus		crust/meadow						
Fucus spiralis		crust/meadow			R		R	R
Fucus vesiculosus		crust/meadow			R		R	R
Pelvetia canaliculata		crust/meadow				O		
Sargassum muticum		crust/meadow						
Chlorophyta	filamentous	massive/turf						
Ulva intestinalis		massive/turf				C		
Ulva lactuca		massive/turf						
Nanozostera noltei	Zostera noltei	crust/meadow						O

Survey Area	Southannan Sands North	Southannan Sands North	Southannan Sands North	Southannan Sands North	Southannan Sands South	Southannan Sands South
Habitat No.	S07	S08	S09	S10	S11	S12
Shore Position	High-Mid	Low	Low	Low	Low	Mid

Taxon	Qualifier	SACFOR class						
Caloplaca	sp.	crust/meadow						
Lanice conchilega		1 - 3 cm			F			
Spirobranchus	sp.	crust/meadow				C		
Semibalanus balanoides		crust/meadow						
Patella	sp.	3 - 15 cm						
Littorina littorea		1 - 3 cm	R	O		F	O	F
Littorina saxatilis		1 - 3 cm	R					
Melarhaphe neritoides		<1 cm						
Nucella lapillus		1 - 3 cm						
Mytilus edulis		3 - 15 cm						O
Rhodophyta	filamentous	massive/turf		R				
Porphyra	sp.	massive/turf						
Corallinaceae	indet. calcareous crusts	crust/meadow				O		R
Phaeophyceae	filamentous	massive/turf	R					
Phaeophyceae	filiform, mat forming	massive/turf		F				
Saccharina latissima		crust/meadow						
Ascophyllum nodosum		crust/meadow						
Fucus	sp. indet.	crust/meadow						
Fucus serratus		crust/meadow						
Fucus spiralis		crust/meadow						
Fucus vesiculosus		crust/meadow						
Pelvetia canaliculata		crust/meadow						
Sargassum muticum		crust/meadow		R				
Chlorophyta	filamentous	massive/turf						
Ulva intestinalis		massive/turf	R					
Ulva lactuca		massive/turf						
Nanozostera noltei	Zostera noltei	crust/meadow						

Survey Area	Southannan Sands South	Southannan Sands South	Southannan Sands South	Southannan Sands South	Hunterston Sands	Hunterston Sands
Habitat No.	S13	S14	S15	S16	H01	H02
Shore Position	Mid	Mid	High	High	High	High

Taxon	Qualifier	SACFOR class						
Caloplaca	sp.	crust/meadow						
Lanice conchilega		1 - 3 cm						
Spirobranchus	sp.	crust/meadow						
Semibalanus balanoides		crust/meadow				R		
Patella	sp.	3 - 15 cm				R		
Littorina littorea		1 - 3 cm						
Littorina saxatilis		1 - 3 cm				R		
Melarhaphe neritoides		<1 cm						
Nucella lapillus		1 - 3 cm						
Mytilus edulis		3 - 15 cm						
Rhodophyta	filamentous	massive/turf						
Porphyra	sp.	massive/turf						
Corallinaceae	indet. calcareous crusts	crust/meadow						
Phaeophyceae	filamentous	massive/turf	O					
Phaeophyceae	filiform, mat forming	massive/turf						
Saccharina latissima		crust/meadow						
Ascophyllum nodosum		crust/meadow						
Fucus	sp. indet.	crust/meadow						
Fucus serratus		crust/meadow						
Fucus spiralis		crust/meadow		R	R	F		
Fucus vesiculosus		crust/meadow						
Pelvetia canaliculata		crust/meadow			R	O		
Sargassum muticum		crust/meadow						
Chlorophyta	filamentous	massive/turf	C					
Ulva intestinalis		massive/turf		A		R		
Ulva lactuca		massive/turf						
Nanozostera noltei	Zostera noltei	crust/meadow						

Survey Area	Hunterston Sands	Hunterston Sands	Hunterston Sands	Hunterston Sands	Hunterston Sands	Hunterston Sands
Habitat No.	H03	H04	H05	H06	H07	H08
Shore Position	Mid	High-Low	Mid	Mid	Mid	Low

Taxon	Qualifier	SACFOR class						
Caloplaca	sp.	crust/meadow						
Lanice conchilega		1 - 3 cm						
Spirobranchus	sp.	crust/meadow						
Semibalanus balanoides		crust/meadow	R		R	R	R	O
Patella	sp.	3 - 15 cm						O
Littorina littorea		1 - 3 cm	R	R	R	R	R	F
Littorina saxatilis		1 - 3 cm						R
Melarhaphe neritoides		<1 cm						C
Nucella lapillus		1 - 3 cm						R
Mytilus edulis		3 - 15 cm						
Rhodophyta	filamentous	massive/turf						
Porphyra	sp.	massive/turf						
Corallinaceae	indet. calcareous crusts	crust/meadow						
Phaeophyceae	filamentous	massive/turf						
Phaeophyceae	filiform, mat forming	massive/turf						
Saccharina latissima		crust/meadow						
Ascophyllum nodosum		crust/meadow						O
Fucus	sp. indet.	crust/meadow						
Fucus serratus		crust/meadow						
Fucus spiralis		crust/meadow	R	R	R			O
Fucus vesiculosus		crust/meadow	R	R	R			F
Pelvetia canaliculata		crust/meadow	R	R				O
Sargassum muticum		crust/meadow						R
Chlorophyta	filamentous	massive/turf						
Ulva intestinalis		massive/turf						
Ulva lactuca		massive/turf	R					
Nanozostera noltei	Zostera noltei	crust/meadow	O					

Survey Area	Hunterston Sands	Fairlie Sands	Fairlie Sands	Fairlie Sands	Fairlie Sands	Fairlie Sands
Habitat No.	H09	F01	F02	F03	F04	F05
Shore Position	Low	High	High	High-Mid	Mid	Low

Taxon	Qualifier	SACFOR class						
Caloplaca	sp.	crust/meadow						
Lanice conchilega		1 - 3 cm		R				
Spirobranchus	sp.	crust/meadow						
Semibalanus balanoides		crust/meadow	C	R	R			
Patella	sp.	3 - 15 cm	O					
Littorina littorea		1 - 3 cm	O	F	O			
Littorina saxatilis		1 - 3 cm		O				
Melarhaphe neritoides		<1 cm						
Nucella lapillus		1 - 3 cm						
Mytilus edulis		3 - 15 cm						
Rhodophyta	filamentous	massive/turf						O
Porphyra	sp.	massive/turf						
Corallinaceae	indet. calcareous crusts	crust/meadow						
Phaeophyceae	filamentous	massive/turf						O
Phaeophyceae	filiform, mat forming	massive/turf						
Saccharina latissima		crust/meadow						O
Ascophyllum nodosum		crust/meadow						
Fucus	sp. indet.	crust/meadow						
Fucus serratus		crust/meadow						C
Fucus spiralis		crust/meadow		R	O	R		
Fucus vesiculosus		crust/meadow						
Pelvetia canaliculata		crust/meadow		R	R	R		
Sargassum muticum		crust/meadow						
Chlorophyta	filamentous	massive/turf						
Ulva intestinalis		massive/turf				O	R	
Ulva lactuca		massive/turf		O		F	R	R
Nanozostera noltei	Zostera noltei	crust/meadow			C	A		

Survey Area	Fairlie Sands	Fairlie Sands
Habitat No.	F06	F07
Shore Position	Low	Low

Taxon	Qualifier	SACFOR class		
Caloplaca	sp.	crust/meadow		
Lanice conchilega		1 - 3 cm		
Spirobranchus	sp.	crust/meadow		
Semibalanus balanoides		crust/meadow	R	R
Patella	sp.	3 - 15 cm		
Littorina littorea		1 - 3 cm	F	O
Littorina saxatilis		1 - 3 cm	R	
Melarhaphe neritoides		<1 cm		
Nucella lapillus		1 - 3 cm		
Mytilus edulis		3 - 15 cm		
Rhodophyta	filamentous	massive/turf		
Porphyra	sp.	massive/turf		R
Corallinaceae	indet. calcareous crusts	crust/meadow		
Phaeophyceae	filamentous	massive/turf		
Phaeophyceae	filiform, mat forming	massive/turf	O	R
Saccharina latissima		crust/meadow		
Ascophyllum nodosum		crust/meadow		
Fucus	sp. indet.	crust/meadow		
Fucus serratus		crust/meadow		
Fucus spiralis		crust/meadow		O
Fucus vesiculosus		crust/meadow		
Pelvetia canaliculata		crust/meadow		
Sargassum muticum		crust/meadow		
Chlorophyta	filamentous	massive/turf		
Ulva intestinalis		massive/turf	R	
Ulva lactuca		massive/turf	R	
Nanozostera noltei	Zostera noltei	crust/meadow		

Appendix V: Biotope glossary

MNCR Biotope Code	MNCR Habitat Name
LR.HLR.MusB.Sem.Sem	*Semibalanus balanoides*, *Patella vulgata* and *Littorina* spp. on exposed to moderately exposed or vertical sheltered eulittoral rock
LR.LLR.F	Fucoids on sheltered marine shores
LR.LLR.F.Fserr.X [variant]	*Fucus serratus* on full salinity lower eulittoral mixed substrata [on artificial substrate with *Saccharina latissima*]
LR.LLR.FVS.FspiVS	*Fucus spiralis* on sheltered variable salinity upper eulittoral rock
LS.LCS	Littoral coarse sediment
LS.LCS.Sh	Shingle (pebble) and gravel shores
LS.LCS.Sh.BarSh	Barren littoral shingle
LS.LSa	Littoral sand
LS.LSa.St	Strandline
LS.LSa.FiSa	Polychaete/amphipod-dominated fine sand shores
LS.LSa.FiSa.Po	Polychaetes in littoral fine sand
LS.LSa.MuSa	Polychaete/bivalve-dominated muddy sand shores
LS.LSa.MuSa.Lan	*Lanice conchilega* in littoral sand
LS.LMu.Mest	Polychaete/bivalve-dominated mid estuarine mud shores
LS.LMx	Littoral mixed sediment
LS.LMx [variant]	Littoral mixed sediment [dead mussel bed]
LS.LBR.LMus.Myt.Mx	Mussels on mixed sediment
LS.LMp.LSgr.Znol	*Zostera noltei* beds in littoral muddy sand