REPLACEMENT SEA WALL, LARGS

Marine Biodiversity Appraisal

EOME0507
Marine Biodiversity Appraisal

Rev02
01 August 2022

rpsgroup.com

Document status

Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
00	Draft	A Crowther & E Goodman	KL	KL	04/07/22
01	Draft to Client	A Crowther	KL	KL	11/07/22
02	Final	A Crowther	EG	KL	01/08/2022

Approval for issue

Kevin Linnane	1 August 2022

© Copyright RPS Group Plc. All rights reserved.

The report has been prepared for the exclusive use of our client and unless otherwise agreed in writing by RPS Group Plc, any of its subsidiaries, or a related entity (collectively 'RPS'), no other party may use, make use of, or rely on the contents of this report. The report has been compiled using the resources agreed with the client and in accordance with the scope of work agreed with the client. No liability is accepted by RPS for any use of this report, other than the purpose for which it was prepared. The report does not account for any changes relating to the subject matter of the report, or any legislative or regulatory changes that have occurred since the report was produced and that may affect the report. RPS does not accept any responsibility or liability for loss whatsoever to any third party caused by, related to or arising out of any use or reliance on the report.

RPS accepts no responsibility for any documents or information supplied to RPS by others and no legal liability arising from the use by others of opinions or data contained in this report. It is expressly stated that no independent verification of any documents or information supplied by others has been made. RPS has used reasonable skill, care and diligence in compiling this report and no warranty is provided as to the report's accuracy. No part of this report may be copied or reproduced, by any means, without the prior written consent of RPS.

Prepared by:

RPS

Adam Crowther
Marine Consultant

Unit 23, Beaufort Park, Riverside Court
Chepstow, Monmouthshire NP16 5UH,
United Kingdom

T +44 [redacted]

E [redacted]

Prepared for:

North Ayrshire Council

George Cruickshank
Project Officer

Cunninghame House
Irvine
KA12 8EE

T +44 [redacted]

E [redacted]

Contents

1 INTRODUCTION 1
1.1 Report Structure 1
1.2 Consultation 4

2 PROJECT DESCRIPTION 7
2.1 Background 7
2.2 Methodology 8
2.2.1 Sea Wall Replacement Works 8
2.2.2 Construction Method 9
2.2.3 Materials 10
2.3 Licensable Marine Activities 10
2.4 Timescales and Duration 11

3 EXISTING ENVIRONMENT 12
3.1 Study Area 12
3.2 Designated Sites 12
3.3 Benthic Ecology 15
3.3.1 Geology 15
3.3.2 Subtidal 15
3.3.3 Intertidal Desktop 15
3.3.4 Phase 1 Intertidal Walkover Survey 16
3.4 Fish and Shellfish 18
3.4.1 Fish Assemblage 18
3.4.2 Diadromous Fish 18
3.4.3 Elasmobranchs 19
3.4.4 Shellfish Assemblage 19
3.4.5 Spawning and/or nursery grounds 19
3.5 Marine Mammals 21
3.6 Marine Ornithology 23
3.6.1 Intertidal 23
3.6.2 Offshore 24
3.7 Invasive Non-Native Species 24

4 EMBEDDED MITIGATION MEASURES 26

5 APPRAISAL OF EFFECTS 27
5.1 Approach 27
5.2 Benthic Ecology 27
5.2.1 Project design footprint leading to removal/disturbance of intertidal benthic habitats 27
5.2.2 Introduction of Invasive Non-Native Species (INNS) on benthic ecology 28
5.3 Fish and Shellfish 28
5.3.1 Project design footprint leading to removal of potential fish feeding grounds 28
5.3.2 Introduction for Invasive Non-Native Species (INNS) on fish and shellfish 28
5.4 Marine Mammals 29
5.5 Marine Ornithology 29
5.5.1 Development activities may result in disturbance to ornithological receptors 29
5.5.2 Development activities may result in potential loss of feeding grounds 29

6 CONSIDERATIONS OF OTHER PROJECTS 31
6.1 Screening of Projects 31

7 HRA SCREENING 32
7.1 Renfrewshire Heights SPA 32
7.2 Inner Clyde SPA 32

7.3 Arran Moors SPA 32
7.4 Loch Lomond SPA 32
7.5 Sounds of Gigha SPA 33
7.6 Endrick Water SAC 33
7.7 Muirkirk and North Lowther Uplands SPA 33
7.8 Inner Hebrides and the Minches SAC....34
7.9 Moine Mhor SAC....34
7.10 Taynish and Knapdale Woods SAC....34

8 SUMMARY OF EFFECTS 35

9 REFERENCES....36

Tables

Table 1.1: Stakeholder consultation. 5
Table 2.1: Details on the construction materials that will be used for the proposal. 10
Table 2.2: Licensable activities....10
Table 3.1: MPA's and designated sites. 14
Table 3.2: Key species with spawning times and spawning and nursery grounds that overlap with the Proposal area (Coull e*t al.*, 1998 and Ellis *et al*., 2012)....20
Table 3.3: INNS in the Firth of Clyde region (Firth of Clyde Forum, 2016) 24
Table 8.1: Description, summary and assessment of impact scenarios. 35

Plates

Plate 1: Southern end of the sea wall.....7
Plate 2: Northern end of the sea wall. 7
Plate 3: Example units. 8
Plate 4: Excavator unloading from dump truck.....41
Plate 5: HGV lorries for delivery of locally sourced rock armour. 41
Plate 6: Loading shovel/telehandler. 41
Plate 7: a crane for lifting units/armour into place or clearing existing sea wall. 41
Plate 8: Concrete wagon. 41
Plate 9: Articulated Dumper Truck....41

Figures

Figure 1.1: Location of the proposed project. 3
Figure 3.1: Location of the Proposal in context of the Clyde Marine Region and Designated Sites. 13
Figure 3.2: Subtidal and Intertidal habitats. 17
Figure 3.3: SCANS III Block G. 22
Figure 9.1: Proposed layout of the sea wall replacement. 39
Figure 9.2: Cross sections of the seawall. 40

1 INTRODUCTION

The town of Largs is located within the Firth of Clyde in North Ayrshire, Scotland, and is a popular seaside resort. The town is protected by a sea wall located on the Largs Promenade which extends from the mouth of the Noddsdale Water southwards to Largs Harbour. The sea wall is located across a 300m stretch of beach north of the RNLI slipway. The location of the sea wall is shown in Figure 1.1.

Recent surveys have indicated that the existing sea wall structure is deteriorating. Specifically, there is clear deterioration of the gunite facing concrete, where it remains attached to the existing wall face, and high levels of corrosion of the existing wall reinforcement. The sea wall is also undermined along a section of wall (approximately 12m in length) where the toe is exposed, and no sheet piles were installed when the sea wall was originally constructed. There is also deterioration to three sets of steps ranging in height from 1.8m to 3.1m located along the length of the sea wall.

On this basis there is a need for the proposed sea wall replacement scheme (herein referred to as the 'Proposal') which comprises the replacement/encapsulation of the existing 300m long sea wall. The work will comprise of the following main activities:

- Demolition / Site Clearance, to include the partial removal of the existing concrete steps with a rock breaker mounted on small excavator working from the beach;
- Protection Works for the existing sea wall structure to include the installation of sheet piles to provide temporary protection against undermining whilst excavations are being carried out. Sheet piles will be installed with a vibratory hammer where possible;
- Excavation: beach material will be excavated to facilitate the installation of the concrete caisson units using a small excavator working from the beach to prevent settlement into the sand; and
- Sea wall installation, including scour protection.

RPS has been commissioned by North Ayrshire Council to prepare and submit the Marine Licence application to Marine Scotland Licensing Operations Team (MS-LOT) for the works proposed below Mean High Water Springs (MHWS) which are licensable under the Marine (Scotland) Act 2010. This Marine Biodiversity Appraisal document supports the Marine Licence application.

1.1 Report Structure

The structure of this document is as follows:

- **Section 2 - Project Description**: this section provides a description of the Proposal, construction methodology and the licensable activities that will be the subject of the application;
- **Section 3 - Existing Environment**: this section provides details of the marine ecology baseline environment in the vicinity of the Proposal;
- **Section 4 - Embedded Mitigation Measures**: this section provides details on the mitigation proposed to be incorporated into the design and construction of the Proposal;
- **Section 5 - Assessment of Effects:** this section provides an appraisal of the potential implications of the licensable activities on marine ecology receptors present in the vicinity of the Proposal;

- **Section 6 - Consideration of Other Projects:** this section considers the implications of other known activities alongside the Proposal;

- **Section 7 - Habitat Regulations Assessment Screening:** This section screens the proposal to determine if there are any likely significant effects on the identified designated sites conservation objectives; and

- **Section 8 - Summary:** this section provides a summary of the Marine Biodiversity Appraisal.

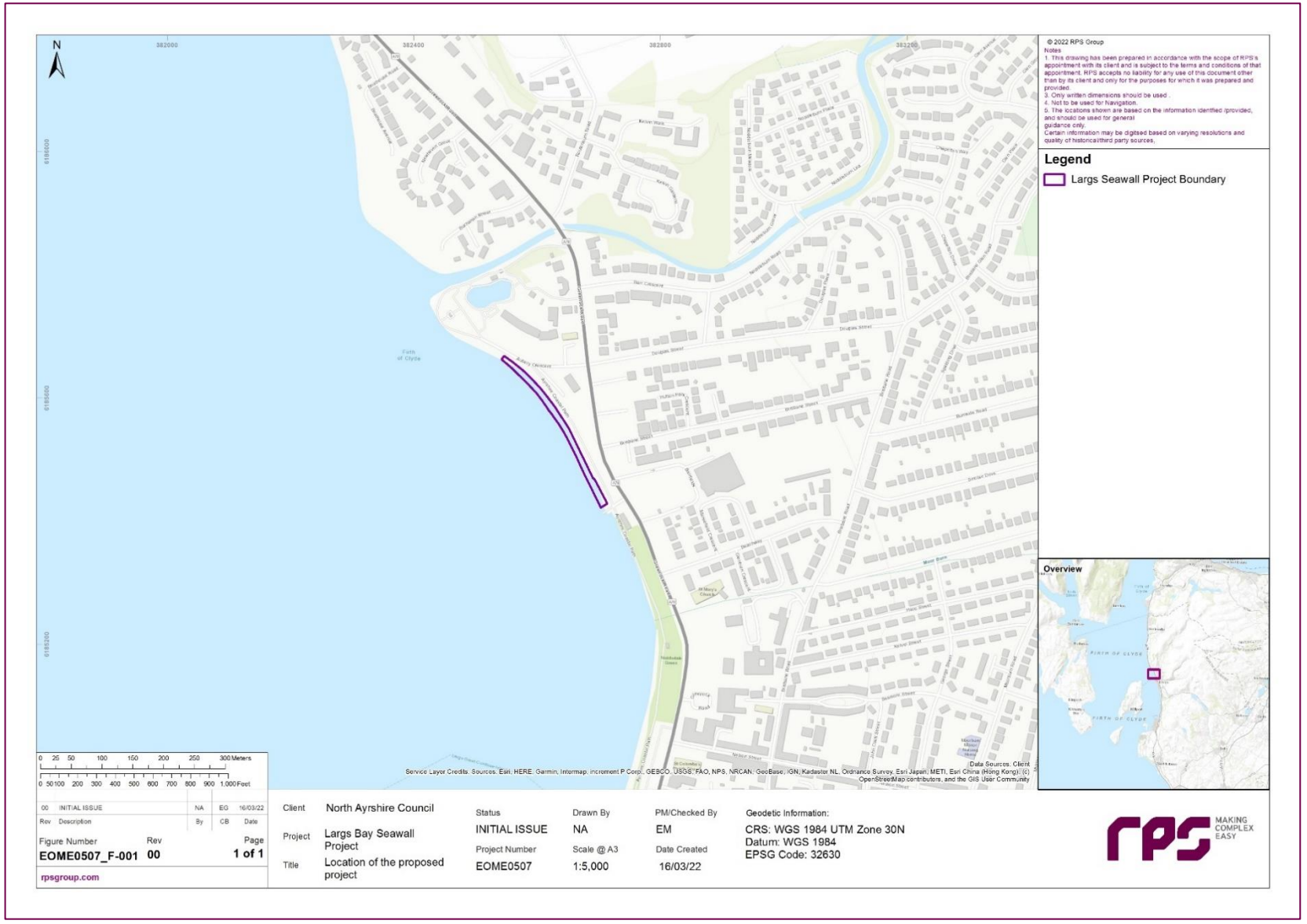


Figure 1.1: Location of the proposed project.

1.2 Consultation

During the preparation of the application of the marine licence for the Proposal, an EIA Screening Opinion was submitted to MS-LOT in November 2021, under Regulation 10(1) Part 2, The Marine Works (EIA) (Scotland) Regulations 2017. Following submission, MS-LOT requested additional information on a number of aspects including:

- Alternative methods of piling, and the potential impacts on marine biodiversity and ornithology;
- Potential impacts on marine ecology, and in particular Priority Marine Features. Details should be provided on the general surveys of the intertidal zone, the nature and extent of ecological habitats that may be impacts, and the potential impacts on ornithological interest in terms of the loss of feeding area; and
- Consideration of the impacts on the risk of spreading Invasive Non-Native Species in the marine environment, and any mitigation strategies to prevent such a spread.

Further consultation with MS-LOT confirmed that a literature review (Marine Biodiversity Desktop Literature; RPS 2022a) on the potential effects on marine ecological receptors was required. This report was submitted to MS-LOT for their consideration as an addendum to the EIA Screening Opinion in May 2022[1].

In accordance with the Marine Licensing (Pre-Application Consultation) (Scotland) Regulations 2013, public consultation was carried out during June 2022. This comprised of:

- An online exhibition of the draft proposals on the North Ayrshire Council consultation website;
- An In-Person Consultation event (27th June); and
- An online / telephone consultation event (28th June).

Several agencies and organisations were formally notified under Section 23 of the Marine (Scotland) Act 2010 to confirm the intention to submit an application for a marine licence for the Proposal:

- Marine Scotland;
- Marine & Coastguard Agency;
- Northern Lighthouse Board;
- NatureScot (Strathclyde-Ayrsire);
- SEPA (Ayr Office); and
- Clyde Marine Planning Partnership.

[1] *At the time of report completion (July 2022) an EIA Screening Opinion was still outstanding.*

Table 1.1: Stakeholder consultation.

Consultee	Issues raised	Where considered in this report	Response to challenge raised
Marine Scotland	Presence of Carpet Sea Squirt (*Didemnum vexillum*), an Invasive Non-Native Species, within the area. Marine Scotland confirms that the Proposal does not require a licence (exemption) due to the species already being establighed at the location.	Embedded Mitigation Measures	Measures have been included to prevent the spread of Invasive Non-Native Species within Section 4: Emmeded Mitigation Measures.
MS-LOT	Alternative methods of piling, and the potential impacts on marine biodiversity and ornithology.	Project Description & Appraisal of Effects	Vibratory and impact piling methods may be used to install sheet piling in the dry, whereby no effects to marine ecological receptors are anticipated (see Appendix C: Screening Exercise). Consideration of effects on marine biodiversity receptors can be found within Section 5: Appraisal of Effects.
MS-LOT	Potential impacts on marine ecology, and in particular Priority Marine Features. Details should be provided on the general surveys of the intertidal zone, the nature and extent of ecological habitats that may be impacts, and the potential impacts on ornithological interest in terms of the loss of feeding area; and	Existing Environment & Appraisal of Effects	A desktop review and an ornithological site-specific survey have been undertaken to aid in the characterisation of the baseline. Further information can be found within Section 3: Existing Environment and within Appendix E: Intertidal and Nearshore Ornithology Surveys.
MS-LOT	Consideration of the impacts on the risk of spreading Invasive Non-Native Species in the marine environment, and any mitigation strategies to prevent such a spread.	Embedded Mitigation Measures & Appraisal of Effects	Measures have been included to prevent the spread of Invasive Non-Native Species within Section 4: Embedded Mitigation Measures.
Public Consultation	Concerns were raised regarding the potential impacts on local wildlife. In particular, there were concerns about the family of swans which frequent the shingle spit north of the current seawall at the mouth of the inlet.	Appraisal of Effects	A desk-based study and site-specific survey were undertaken for ornithological receptors. The purpose of these reports were to identify areas, within and in proximity to the Proposal, which support significant numbers of qualifying species of designated sites and any areas which are important for large assemblages of birds. Information within these reports has been captured within the Marine Biodiversity Appraisal – Section 3.6: Marine Ornithology. This section specifically notes that a nesting pair of mute swans were found within the survey area, 100 m north of the Proposal. From this baseline summary, an appraisal of effects was undertaken for disturbance and potential loss of feeding grounds for marine ornithological receptors. In both cases, effects from the Proposal were found to be negligible. Therefore, effects on the nesting pair of swans raised during consultation is negligible.
Public Consultation	Clarification on any measures to ensure no unacceptable impacts on marine life, including swans and seals.	Embedded Mitigation Measures	A Marine Biodiversity Desktop Literature Review (screening exercise) was undertaken to screen out receptors that have not been considered further for appraisal, and submitted to MS-LOT. As part of this screening exercise, marine mammals (including seals) were screened out on the basis that there

Consultee	Issues raised	Where considered in this report	Response to challenge raised
			was no effect pathway as works are to be undertaken in the dry and that the nearest seal haul-out site designated under the Marine Scotland Act is 30 km away. For receptors screened in, these were taken forward for further consideration within the Marine Biodiversity Appraisal. In all cases, effects from the Proposal were found to be of negligible effect. Additionally, within the embedded mitigation measures if deemed necessary an Environmental Clerk or Works will be appointed to avoided to ensure no infringement of sensitive features e.g. nesting birds or individual marine mammals. See above point for consideration of effects on marine ornithological (swans) receptors.
Public Consultation	Changes in the coastal processes will affect the shingle spit and thereby impact on the nesting / roosting of the seabirds in the area.	See 'Response to challenge raised'	The Proposal aims to replace/encapsulate the existing sea wall within the same footprint and is unlikely to affect the local hydrodynamic regimes. Considerations of coastal processes in the area as a result of the scheme have determined that: 1. Both existing & proposed structures have the same structure and wave reflection characteristics & crest levels; 2. The Proposal will not measurably alter the tidal or littoral current field along the Largs frontage (they will be in the same model cell therefore the modelled tidal/littoral velocities will be the same); and 3. No change to beach sediment transport, and with the scour protection layer, no change to the natural surface beach material. Additionally, the shingle spit to the north has been formed as a result of depositions from the River Inlet. See above point for consideration of effects on marine ornithological (swans) receptors.

2 PROJECT DESCRIPTION

2.1 Background

The Largs Promenade extends from Largs Harbour at the south to the mouth of the Noddsdale Water at the north, with a wall along the seaward length of the promenade transitioning to a sea wall from the Royal National Lifeboat Institution (RNLI) slipway for approximately 300m north. Largs is a coastal town, which is located due west of Glasgow, within North Ayrshire Council area. The general location of the proposed works is shown above, in Figure 1.1.

The existing sea wall at Largs retains the promenade and protects the shore side buildings and infrastructure from wave action and coastal erosion. It is circa 300m in length, with the height varying along its length following the profile of the beach below. The retained height varies from approximately 1.0m to 4.0m, and the top level of the sea wall is approximately +5.16m CD along the full length. The public have access to the sea wall and the beach below.

It was constructed from reinforced concrete in the 1970s as a replacement facing for the old sea wall. This 1970s facing was covered in a gunite (sprayed concrete) facing in more recent years, but this has since failed and become detached from the 1970s concrete wall. The gunite was partially removed in 2018.

Plate 1: Southern end of the sea wall.

Plate 2: Northern end of the sea wall.

Plate 1 and Plate 2 show the existing sea wall, and the different profiles along its length. Surveys have indicated that the existing sea wall structure is deteriorating in several ways:

Concrete Deterioration: There is clear deterioration of the gunite facing concrete, where it remains attached to the existing wall face. There are high levels of corrosion of the existing wall reinforcement, with patches of exposed reinforcement visible throughout the length of the wall. High levels of chloride ingress to the existing concrete wall have also been identified.

Undermining: The sea wall is undermined along a section of wall (approximately 12m in length) where the toe is exposed, and no sheet piles were installed. This undermining is the likely cause of loss of material and subsidence of the promenade surface in recent years.

Steps: There are three sets of steps ranging in height from 1.8m to 3.1m located along the length of the length of the sea wall. These are unsafe for use and are currently fenced off.

2.2 Methodology

2.2.1 Sea Wall Replacement Works

The proposed sea wall replacement scheme comprises the replacement/encapsulation of the existing 300m long sea wall. Works associated with the Proposal are outlined in detail in Appendix A: Figure 9.1. It consists of the following main elements:

- Controlled removal of existing steps which are unsafe for use.
- Installation of precast concrete caissons along the front of the existing sea wall to act as a foundation to facilitate the placement of precast concrete sea wall units.
- The precast caisson base units will be filled with granular material. The base units will be topped with a mortar layer, with the precast concrete sea wall units then installed (example of proposed sea wall units shown in Plate 3). The precast units will be shaped to facilitate interlock between units, then grouted and sealed to both sides, thus avoiding the requirement for dowels or protruding reinforcement.
- Placing of granular backfill between the front face of the existing sea wall structure, and the rear face of the new precast structure. Suitable drainage to be provided within the backfill. Surfacing of backfill with concrete or asphalt pavement to tie into existing promenade. New / reinstatement of handrail along the promenade.
- Placement of rock armour scour protection in front of the new precast concrete sea wall units to prevent undermining of the toe of the new structure.
- Installation of steps at required intervals along sea wall structure.

Plate 3: Example units.

The height of the replacement sea wall structure will be as per the existing sea wall. The length of the proposed sea wall will be 300m, and the footprint of the structure covers approximately 2,400m^2. The form of foundation and structure varies along the length of the sea wall to account for the varying profiles of the existing sea wall structure, the preliminary design drawing in Appendix A: Figure 9.1 and Figure 9.2 show indicative cross sections of the proposed construction[2].

[2] It should be noted that these designs are at a preliminary design stage only and will be subject to detailed design pending results of further investigation works.

The red line boundary of the Proposal identified in Appendix A: Figure 9.1 totals 6,251m^2 in area extending from the terrestrial environment (above the Mean Low Water Springs (MLWS)) onto the foreshore (i.e. below the Mean High-Water Springs (MHWS)). The area of construction works to be undertaken below MHWS totals 2,343m^2.

2.2.2 Construction Method

This section outlines the construction methodology for the sea wall replacement works. Examples of plant and equipment can be found in Appendix B.

2.2.2.1 Demolition & Site Clearance

There will be a temporary site compound in the immediate vicinity of the site to support the proposed development during the construction period. The location of this has not yet been determined, but will be in an onshore location, so is not relevant for marine licensing. The area of works along the promenade and beach will be fenced off, and initial works will see the partial removal of the existing concrete steps with a rock breaker mounted on small excavator working from the beach. The existing handrail along the promenade will be removed and stored for reuse. This phase is likely to take approximately 3 weeks.

2.2.2.2 Protection Works for the Existing Sea wall structure

Sheet piles will be installed to the front edge of the toe along the length of the existing wall to provide temporary protection against undermining whilst excavations are being carried out. These will be installed using a vibratory hammer where possible. It is expected that due to the nature of the ground conditions to the south of the site an impact hammer may be required to install the piles. It is conservatively estimated that 150 m of the 300 m anticipated length of piling may be driven by means of impact piling. This phase is likely to take approximately 6 weeks and would run concurrent to removal of the steps.

2.2.2.3 Excavation

Beach material will be excavated to facilitate the installation of the concrete caisson units using a small excavator working from the beach to prevent settlement into the sand. The material is likely to be taken offsite for disposal to a licenced facility or beneficially re-used (subject to testing to confirm suitability of material, and identification of a suitable receptor). This phase is likely to take circa 9 weeks.

2.2.2.4 Sea wall Installation

Bedding material (lean mix concrete) will be placed in the excavation to form a level foundation for the placement of the caisson units. The caisson units will be installed on top of the material by a crane or telehandler on the promenade or beach and filled with granular material. The precast concrete sea wall unit will be placed on top and grouted into place. The space between the replacement sea wall unit and the face of the existing sea wall will be backfilled and compacted by an excavator working from the promenade, then surfaced with asphalt / paving to tie into the existing promenade, with the existing handrail reinstated. Steps and a new handrail to be installed. The precast installation is likely to take circa 9 weeks, with the backfilling and paving taking approximately 8 weeks.

A suitably sized and graded rock armour will be placed in layers on the beach in front of the new precast concrete sea wall to act as scour protection. This rock armour will be placed by an excavator working on the beach area. The timing of each phase of works will possibly be subject to tidal restrictions on working.

2.2.3 Materials

The types of construction material that will be used as part of the proposed permanent works below MHWS includes precast concrete caissons, precast concrete sea wall units, granular infill, mortar layer, sealant, granular backfill, bedding material and rock armour scour protection. Temporary works include the installation of the sheet piles.

Table 2.1 provides details of the type, volume and descriptions/assumptions. Note, all materials are expected to be sourced locally, regionally or within the UK and brought to site via road.

Table 2.1: Details on the construction materials that will be used for the proposal.

Type	Volume below MHWS (m^3)	Units	Description/assumptions
Precast Concrete Caissons	585	150	Concrete caissons are 2m long; smaller caisson (top of caisson level with MHWS); larger caisson (top of caisson below MHWS); volume assumed for concrete units alone.
Precast Concrete Sea Wall Units	305	108	Concrete wall sections are 2m long; smaller type all above MHWS; larger type extend to below MHWS.
Granular Infill	1000	N/A	Coarse gravel infill material to caissons.
Mortar layer	3	N/A	Layer assumed to be 50 mm thick.
Grout	3	N/A	Assume 20 mm grout between each unit.
Sealant	0.23	N/A	Typically measured in linear m of 20mm x 20mm.
Granular Backfill	325	N/A	Class 6A/6N material to be used.
Handrail	N/A	5m	Assumes reuse of existing handrails.
Rock Armour Scour Protection	900	N/A	Rock armour/scour protection expected to be relatively small – approximately 100kg from UK quarries.
Bedding material	45	N/A	Blinding concrete material.
Sheet Piles	m^2	900m^2	Measured in square metres (face area of sheet piles)

2.3 Licensable Marine Activities

The majority of the works associated with the Proposal are below MHWS and these are licensable under the Marine (Scotland) Act 2010 and are the focus of the Marine Biodiversity Appraisal set out in this document. However as certain non-licensable activities can increase the duration and extent of the impact (e.g. use of plant and presence of human activity during surveys leading to disturbance effects), these wider activities are also considered in the Marine Biodiversity Appraisal (where relevant).

A summary of licensable activities are described in Table 2.2.

Table 2.2: Licensable activities.

Licensable Activity	Description
Removal of sediment	• The proposed works include removal of beach material from the intertidal zone to facilitate the installation of the concrete caissons. The sediment will be removed by excavator positioned on the beach.
Removal of substances and objects from the intertidal zone	• Removal of concrete steps and pre-cast concrete blocks as part of re-profiling of the existing sea wall.
Deposits in the sea or on/under the intertidal zone	• Placement of rock protection along the toe of the sea wall on the intertidal zone. • Installation of sheet piles along the front edge of the sea wall to prevent undermining. • Lean mix concrete added to the toe trench as bedding material.

Licensable Activity	Description
	• Placement of concete caissons via telehandler or crane and filled with granular infill material. • Placement of precast concrete sea wall units and grouted into place. • Granular backfill poured behind the concrete sea wall units, with drainage, and surfaced with concrete or ashphalt. • Reinstallation of exisiting (or new) handrails.

2.4 Timescales and Duration

The proposed works are anticipated to be completed over a period of 30 weeks, starting construction works in summer 2023.

Preparation, mobilisation and site clearance will take approximately 4 weeks. Protection works for the existing sea wall units, 6 weeks. Excavation of the footings, 7 weeks. Sea wall installation works, 21 weeks, with time for finalising (snagging), demobilisation and contingency, 5 weeks.

3 EXISTING ENVIRONMENT

3.1 Study Area

The study area used for this Marine Biodiversity Appraisal to guide the review of existing baseline information is the Clyde Scottish Marine Region (Marine Scotland, 2021; Figure 3.1) or localised within this as an appropriate for the receptor. A broader study area has been described/referenced for marine mammals, where the appropriate SCANS blocks have been utilised.

3.2 Designated Sites

All designated sites with qualifying interest features that could be potentially impacted by the Proposal were identified using the following approach:

- Step 1: All designated sites of international, national and local importance were identified using Marine Scotland's NMPI, the Joint Nature Conservation Committee's (JNCC's) website and the European Site European Nature Information System (EUNIS) database;
- Step 2: Information was compiled on the relevant qualifying feature for each of these sites by examining JNCC and EUNIS databases; and
- Step 3: Using the above information and expert judgement, sites were included in the assessment if:
  - A designated site directly overlaps with Proposal;
  - Sites and associated features were located within the potential Zone of Influence (ZoI) of the Proposal, based on expert judgement;
  - Qualifying features of a designated site were either recorded as present during historic surveys within Proposal area, or identified during the desktop study as having the potential to occur within Proposal area; and
  - Where a national site falls outside of an international site, but is located within identified study areas, the national site has been taken forward for further consideration for a particular feature.

The Proposal is not located within a site designated as part of the National Site Network (i.e. Special Area of Conservation, SAC, or Special Protection Area, SPA; Figure 3.1). A list of identified international and national designated sites, distance from project and qualifying features in the vicinity of the Proposal is presented in Table 3.1.

These designated sites are offered protection under The Conservation of Habitats and Species Regulations 2017 (as amended), known as the Habitat Regulations. These require that where a plan or project is likely to have a significant effect on a designated site (specifically SAC, SPA or Ramsar), either individually or in combination with other plans or projects, it shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. Marine Scotland, as the competent authority, must therefore consider whether the Proposal is likely to have significant effects on the conservation objectives of the sites considered. Where a Likely Significant Effect (LSE) cannot be excluded at the screening stage, and in the absence of mitigation measures, an 'Appropriate Assessment' of the implication of the plan or project must be undertaken by the competent authority before consent may be given for the proposed project.

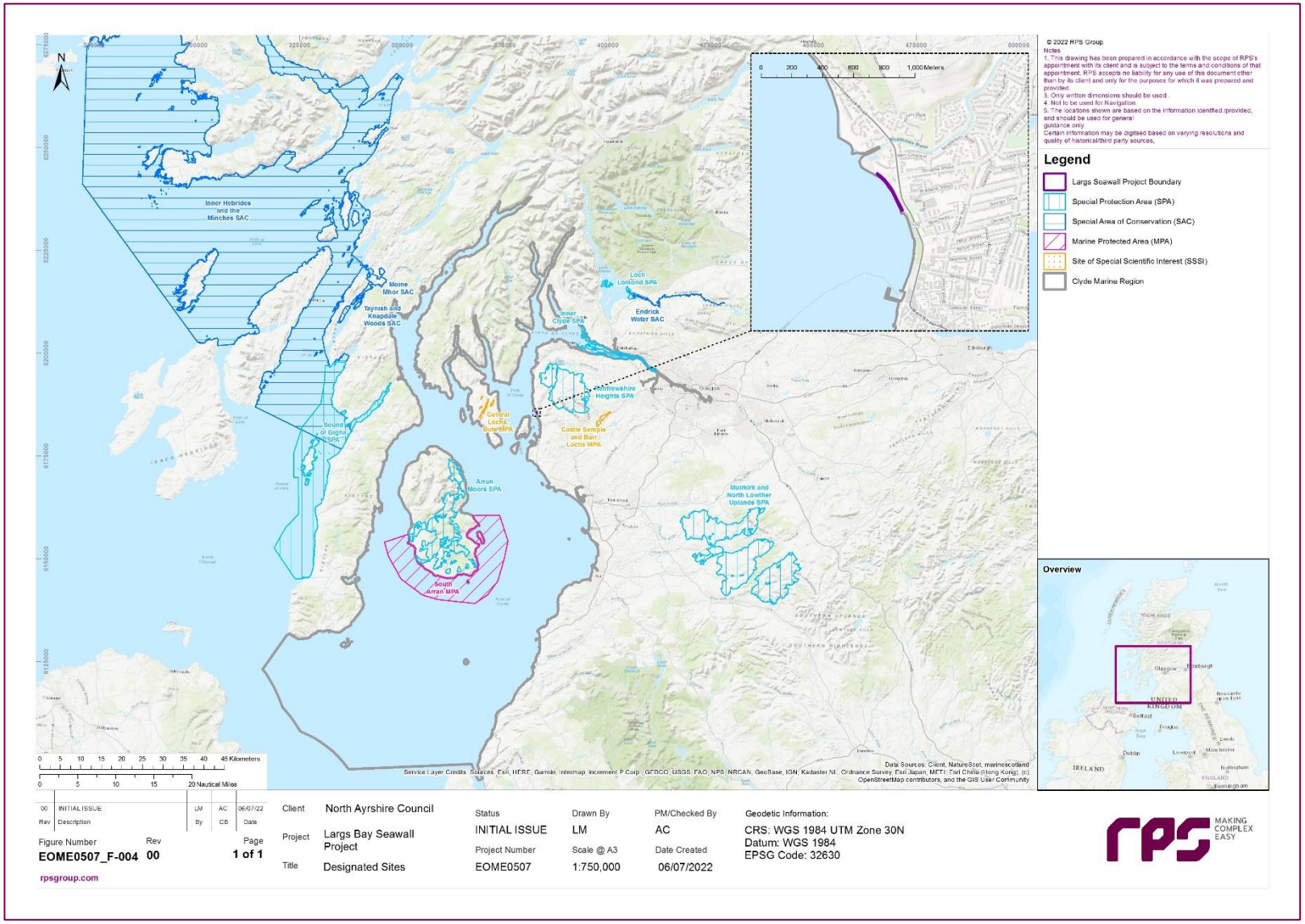


Figure 3.1: Location of the Proposal in context of the Clyde Marine Region and Designated Sites.

The nearest designated SAC or SPA is the Renfrewshire Heights SPA located 4 km to the north east of the Proposal which is designated for Hen Harrier *Circus cyaneus*. Other designated sites include the Inner Clyde SPA (19 km north east of the Proposal), Arran Moors SPA (23 km south west of the Proposal), Loch Lomond SPA (35 km north east of the Proposal), Sounds of Gigha SPA (36 km to the west of the Proposal), Endrick Water SAC (37 km to the north east of the Proposal), Muirkirk and North Lowther Uplands SPA (43 km south east of the Proposal), Inner Hebrides and Minches SAC (45 km north west of the Proposal), Moine Mhor SAC (48 km north west of the Proposal), and Taynish and Knapdale Woods SAC (50 km to the north west of the Proposal).

The nearest Marine Protected Area (MPA) is the South Arran MPA, located approximately 26 km to the south west of the proposed works and is designated for Burrowed Mud, and Kelp and Seaweed Communities.

The nearest Special Site of Scientific Interest (SSSI) is the Central Loch, Bute SSSI (11 km west of the Proposal) designated for Greylag Goose *Anser anser*. The Castle Semple and Barr Lochs SSSI (located 15 km east of the Proposal) designated for its breeding bird assemblage.

Table 3.1: MPA's and designated sites.

Protected Area	Distance and Direction from Project	Relevant Qualifying Features
Renfrewshire Heights SPA	4 km	Hen harrier *Circus cyaneus*
Central Lochs, Bute SSSI	11km	Greylag goose *Anser anser*
Castle Semple and Barr Lochs SSSI	15 km	Breeding bird assemblage: Great crested Grebe *Podiceps cristatus,* Tufted duck *Aythya Fuliga,* Water rail *Rallus Aquaticus,* Sedge warbler *Acrocephalus Schoenobaenus*, Reed bunting *Emberiza Schoeniclus*
Inner Clyde SPA	19 km`	Cormorant *Phalacrocorax carbo* Goldeneye *Bucephala clangula* Eider *Somateria mollissima* Oystercatcher *Haematopus ostralegus* Red-breasted merganser *Mergus serrator* Redshank *Tringa totanus* Red-throated diver *Gavia stellata* Saltmarsh
Arran Moors SPA	23 km	Hen harrier *Circus cyaneus*
South Arran MPA	26 km	Burrowed Mud Kelp and Seaweed Communities
Loch Lomond	35 km	Capercaillie *Teyrao urogallus*
Sound of Gigha SPA	36 km	Common eider *Somateria mollissima* Great northern diver *Gavia immer* Red-breasted merganser *Mergus serrator* Slavonian grebe *Podiceps auritus*
Endrick Water SAC	37 km	Atlantic salmon *Salmo salar* Brook lamprey *Lampetra planeri* River lamprey *Lampretra fluviatilis.*
Muirkirk and North Lowther Uplands SPA	43 km	Golden plover *Pluvialis apricaria* Hen harrier *Circus cyaneus* Merlin *Falco columbarius* Peregrine *Falco peregrinus*

Protected Area	Distance and Direction from Project	Relevant Qualifying Features
		Short-eared owl *Asio flammeus*
Inner Hebrides and the Minches SAC	45 km	Harbour Porpoise *Phocoena phocoena*
Moine Mhor SAC	48 km	Otter *Lutra lutra*
Taynish and Knapdale Woods SAC	50 km	Otter *Lutra lutra*

3.3 Benthic Ecology

This section describes the Benthic Ecology found both subtidally and intertidally within the Proposal and wider area. A description of the local geology is provided as benthic ecology is dependent on the superficial geological deposits found within the area. The Marine Biodiversity Desktop Literature Review determined that there was limited primary and secondary literature within this area, therefore a site-specific Phase 1 intertidal walkover survey has been undertaken, the Technical Report can be found in Appendix E. This report has been summarised within this section.

3.3.1 Geology

The Proposal is found in an area where Kelly Burn Sandstone bedrock underlies the much younger Holocene deposits comprising a sequence of indurated sedimentary rock (clay, silt, sand and gravel) (BGS, 2019). Along the top of the foreshore lies the concrete seawall giving way to beach. The beach is comprised of coarse and fine sediments and are present interstitially.

During the site-specific survey, sediments processed were dominated by cobbles, pebbles, and coarse sand. Most of the survey area was reflective in terms of wave energy with cobbles and pebbles dressing the surface of the beach. At the lower shore where the angle of slope decreased, and wave energy was more dissipative, with narrow strips and patches of coarse sand of ~5-10cm deep lay over cobbles and pebbles. These sediment types are likely to continue into the subtidal environment.

3.3.2 Subtidal

Broadscale subtidal habitats are shown in Figure 3.2. Noting that these data (from EMODNet) are very broadscale datasets, these suggest that subtidal areas of Largs Bay are characterised by high to moderate energy circalittoral and infralittoral seabed, with predominantly mud habitat further offshore areas. Areas of subtidal rocky habitats are also potentially present closer to shore. Species associated with this habitat type include kelps and algae.

3.3.3 Intertidal Desktop

Site specific surveys, undertaken for the Millport Coastal Protection Scheme, located approximately 6 km to the southwest and has a similar geology, indicated that hard structures were dominated by pattern of yellow and grey lichens communities on the upper shore *Verrucaria maura* and sparse barnacles on upper and mid shore and barnacle dominated communities with limpets and littorinids on the mid to lower shore. The more mobile sand, shingle and cobbles are likely to be characterised by amphipods and polychaetes typical of an intertidal sand and shingle shore.

A widespread benthic survey was undertaken in 1979 in the Clyde by Paisley College of Technology (Connor, 1998). The survey found sheltered areas of the Clyde such as Loch Fyne, Striven and Gareloch to have the richest sediment shores hosting high diversity and biomass of benthic species. Whereas more exposed areas of Ayrshire (e.g. settings similar to Largs Bay) such as the Kintyre peninsula and the coast of Arran hosted fewer individuals and less species diversity. Connor (1998) reported intertidal species present such as the bivalves *Angulus tenuis* and *Cerastoderma edule*, the amphipod *bathyporeia sp.* and polychaetes *Scoloplos armiger*, *Pygospio elegans*, *Arenicola marina* and *Nephtys cirrosa*. Intertidal fauna of sandy beaches in the Firth of Clyde was also studied by Eleftheriou and McIntyre (1976). Exposed shores were found to be dominated by crustaceans and polychaetes and the bivalve *Angulus tenuis*. Whilst more sheltered beaches were found to have a high biomass of bivalves and fewer crustaceans.

3.3.4 Phase 1 Intertidal Walkover Survey

As outlined above, a site-specific intertidal walkover survey was undertaken on 6th April 2022 and mapped all intertidal sediments, communities and ultimately biotopes in the vicinity of the Proposal. The survey found that the site had a small tidal range with a narrow intertidal zone with a seawall constructed from concrete present at the head of the beach. Large slabs (25 cm - >1m) had fallen off the seawall and lay scattered around the intertidal zone.

Several species of flora and fauna indicated a low/variable salinity within the survey area, particularly towards the north of the site. The survey area contained a restricted array of commonly occurring species and biotopes (Figure 3.2). The biotope LS.LSa.St.Tal Talitrids dominated the upper shore and strand-line, giving way to a mosaic of 80% LR.MLR.BF.Fser *Fucus serratus* on moderately exposed lower eulittoral rock and 20% LS.LSa.MuSa.Lan *Lanice conchilega* in littoral sand along the mid – lower shore. Patches of LR.LLR.FVS.FspiVS *Fucus spiralis* on sheltered variable salinity upper eulittoral rock and LS.LSa.MuSa.Lan *Lanice conchilega* in littoral sand were observed to the north west of the survey area. The following biotopes qualify as component biotopes of the Annex I Habitats Directive habitat – *1140 Mudflats and sandflats not covered by seawater at low tide*:

- LS.LSa.St.Tal Talitrids on the upper shore and strand-line; and
- LS.LSa.MuSa.Lan, *Lanice conchilega* in littoral sand.

Sediments processed within the survey area were dominated by cobbles, pebbles, and coarse sand. Most of the survey area was reflective in terms of wave energy with cobbles and pebbles dressing the surface of the beach. At the lower shore where the angle of slope decreased, and wave energy was more dissipative, narrow strips and patches of coarse sand ~ 5-10cm deep lay over cobbles and pebbles.

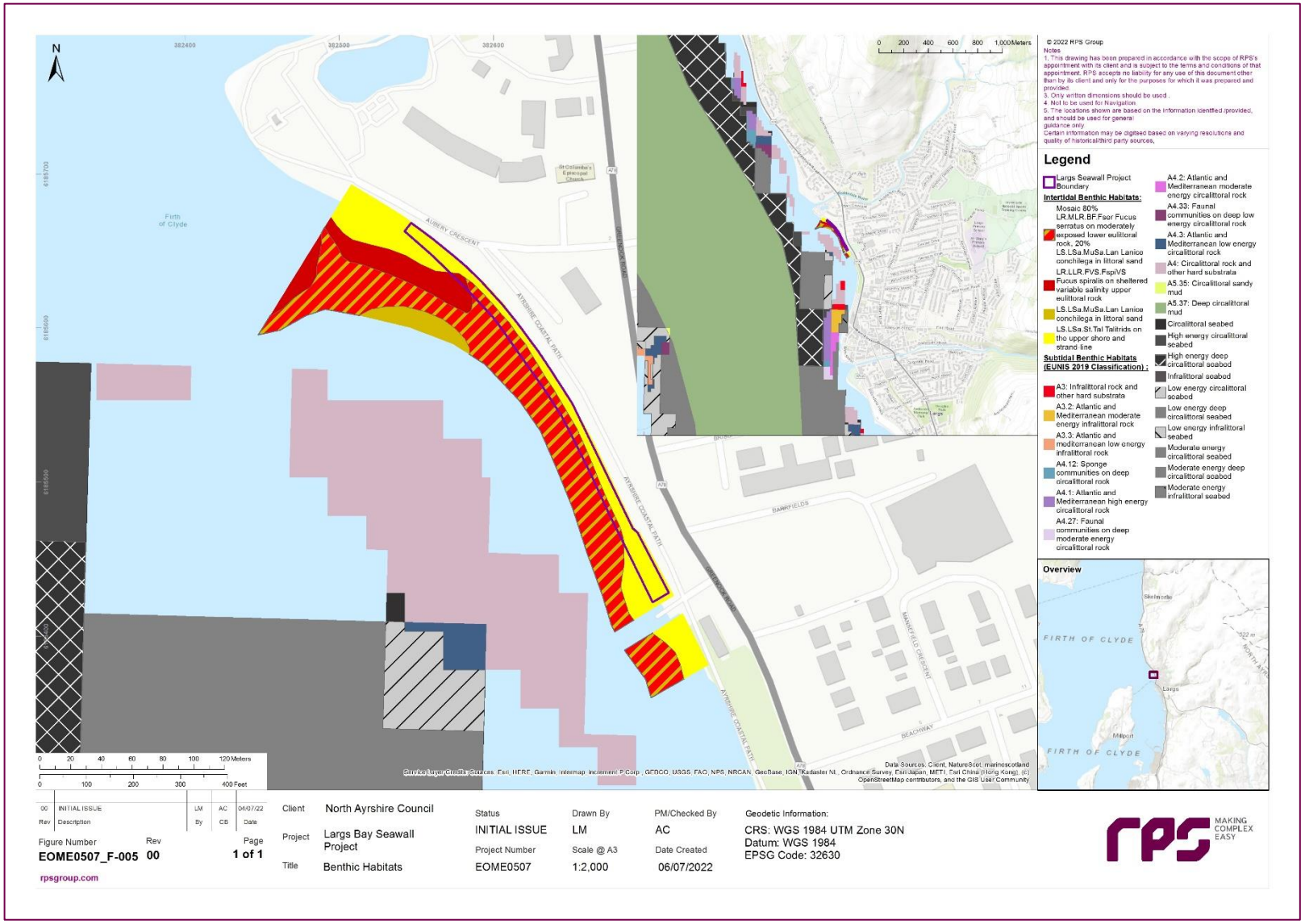


Figure 3.2: Subtidal and Intertidal habitats.

3.4 Fish and Shellfish

This section describes the regional and local fish and shellfish assemblages found within the Firth of Clyde. Providing information on diadromous fish, elasmobranchs, shellfish, and fish spawning and nursery grounds.

3.4.1 Fish Assemblage

Data on fish communities has been provided from the Millport Coastal Protection Scheme with sampling at Kames Bay, located 6 km from Largs Bay and therefore likely to be representative of those communities in Largs Bay. The area is used during the summer months for juvenile feeding grounds for flatfish, dogfish, wrasse species and numerous other intertidal species common to the West coast of Scotland including the intertidal goby and blenny species, butterfish and scorpion fish. There are spawning grounds for sandeel *Ammodytes marinus* and *Ammodytes tobianus*, European sprat *Sprattus sprattus* and Nephrops within the vicinity of Largs Bay (noting that these datasets are very broadscale and unlikely to extend into intertidal areas) (Marine Scotland, 2019). Similarly, the region has been identified as a nursery ground for the following species: whiting *Merlangius merlangus*, sandeel, saithe *Pollachius virens*, plaice *Pleuronectes platessa*, herring *Clupea harengus* and Nephrops (Marine Scotland, 2019; see Section 3.4.5 for further information).

A long-term demersal fish survey was conducted in the Firth of Clyde by Health and Speirs (2012). Common species recorded in the survey included: hake *Merluccius merluccius*, long rough dab *Hippoglossoides platessoides*, cod *Gadus morhua*, whiting. Pelagic species also recorded were herring *Clupea harengus* and sprat *Sprattus sprattus.*

3.4.2 Diadromous Fish

Atlantic salmon *Salmo salar* have been found within the river directly to the north of the Proposal, the River Noddsdale Water, and are also likely to be present in the River Gogo Water, directly south. The Endrick Water SAC is located 37 km to the northeast of Largs Bay and is designated for diadromous Atlantic salmon, and river lamprey *Lampretra fluviatilis*. The River Ayr is also located 32 km to the south of the project and contains diadromous populations of Atlantic salmon and European eel *Anguilla anguilla,*

Two species of anadromous fish, the Atlantic salmon and river lamprey, and the catadromous fish species European eel have the potential to be found within the study area.

The juvenile life stage typically lasts between one to four years before migrating to the sea. Following migration to the sea, salmonids are known as post-smolts until the spring of the following year and after one winter as grilse. Adult salmonids spend the majority of their lives at sea, growing rapidly and only returning to freshwater environments to spawn from November to December (extending from October to late February) (NatureScot, 2022). Due to a highly acute sense of smell, the Atlantic salmon, upon reaching maturity, is able to migrate back to its natal river (Dipper, 2001; Lockwood, 2005). The length of time an Atlantic salmon spends in the sea varies from one to five years (NatureScot, 2022).

Atlantic salmon are widely distributed throughout Scotland and are recognised as Annex II (EU Habitats Directive), British Action Plan (BAP) species, Scottish Priority Marine Feature (PMF) (juvenile) and as an OSPAR species. They are currently both nationally and internationally important species. In recognition of the importance of Scottish salmon populations, 17 rivers have been designated as SACs for the Atlantic salmon, with the nearest being the Endrick Water SAC, 37 km north east of the Proposal.

The European eel was last recorded, in the immediate vicinity of Largs, in 1990 (NBN Atlas, 2022). No river lampreys have been identified within the Largs area (NBN Atlas, 2022).

3.4.3 Elasmobranchs

Elasmobranchs are a cartilaginous fish group that comprises sharks, rays and skates. Shark species expected to be present in the area and listed as a priority marine feature include basking sharks *Cetorhinus maximus*and spurdog *Squalus acanthias* (Coull *et al.*, 1998; Ellis *et al.*, 2012; Baxter *et al.*, 2011). The main species of skate and ray present are thornback ray *Raja clavata* and common skate *Dipturus intermedia* (Ellis *et al.,* 2012; Baxter *et al.*, 2011).

The basking shark has been identified in close proximity to the Proposal area, circa 500 m west. However, this sighting was recorded in 2006. Other sighting records have determined that basking shark tend to cluster in the waters around the Firth of Clyde (approximately 20 km southwest of Largs) (NBN Atlas, 2022), coinciding with plankton-rich waters (Speedie *et al.*, 2019) and the Isle of Arran is considered a particular 'hotspot' for basking shark sightings (McIntyre *et al.*, 2012).

3.4.4 Shellfish Assemblage

Shellfish are aquatic demersal shelled molluscs and crustacea. The coast around Largs Bay lies within the ICES rectangle 40E5. Using commercial landing data for this ICES rectangle as a proxy for species present in proximity to the Proposal and within the wider area, species most caught include the *Nephrops*, razor clam *Solen* spp., whelks *Buccinum undatumm,* scallops *Pecten maximus*, brown crab *Cancer pagarus* and lobster *Homarus gammarus.*

There are no classified shellfish harvesting waters or shellfish water protected areas that overlap with Proposal.

3.4.5 Spawning and/or nursery grounds

Species with known spawning periods and nursery habitats identified within the study area have been summarised in Table 3.2.

Table 3.2: Key species with spawning times and spawning and nursery grounds that overlap with the Proposal area (Coull e*t al.*, 1998 and Ellis *et al*., 2012).

Common Name	Species	Spawning grounds	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Nursery grounds
Anglerfish	*Lophius piscatorius*														
Cod	*Gadus morhua*														High Intensity
Common skate	*Dipturus intermedia*		Unknown												
European hake	*Merluccius merluccius*														
Herring	*Clupea harengus*[1]														High Intensity
Mackerel	*Scomber scombrus*														
Sandeel	*Ammodytidae*[1,2]														
Spurdog	*Squalus sp.*[1, 2, 4]														High Intensity
Whiting	*Merlangius merlangus*[2]														High Intensity

1. BAP Species
2. Priority Marine Feature
3. OSPAR
4. IUCN Red List

Spawning period | Peak spawning | Grounds overlap with Proposal

3.5 Marine Mammals

The northeast of Scotland is comparatively diverse in cetacean species with eight out of 26 cetacean species recorded in the UK regularly recorded in the region (Evans *et al*., 2011). Cetacean species known to occur within the area, identified through SCANS-III surveys (Figure 3.3) include:

- harbour porpoise *Phocoena phocoena*;
- bottlenose dolphin *Tursiops truncatus*;
- minke whale *Balaenoptera acutorostrata*; and
- white-beaked dolphin *Lagenorhynchus albirostris*.
- northern bottlenose whale *Hyperoodon ampullatus*, killer whale *Orcinus orca*, Risso's dolphin *Grampus griseus*

The most common cetacean species in Scotland's nearshore waters (within 60 km of the coast) are the harbour porpoise and bottlenose dolphin followed by minke whale and white beaked dolphin. Several species of marine mammal have been recorded in and around the Firth of Clyde include northern bottlenose whale, killer whale, Risso's dolphin, minke whale and harbour porpoise, all were reported in relatively low numbers (SeaWatch Foundation, 2020). Largs Bay is located to the north west, outside of Survey Block G, however as cetaceans are migratory species that data can still be used. Cetaceans identified during SCANS III surveys, include the following species: harbour porpoise (density of 0.336 individuals/km^2), bottlenose dolphin (0.1206 /km^2), minke whale (0.0271/km^2) (Hammond *et al.*, 2017).

Grey and harbour seals are both resident in Scottish waters. Both species use coastal sites for breeding/pupping and hauling out, and feed in inshore and offshore waters. Under the Marine Scotland Act, Marine Scotland has designated 194 coastal sites around Scotland as seal haul-out sites. Three sites occur within 50 km from the project site, the closest being approximately 30 km to the south (Marine Scotland, 2019). Low densities of harbour seal are expected within the proposed works area, at sea usage was determined to be low – medium (SMFS *et al.*, 2020), informed by data from (Carter *et al.* 2020) and (Russell *et al.*, 2017). However, grey seal density is considered to be between 50 and 100 animals per 25 km^2. At sea usage was determined to be medium - high (SMFS *et al.*, 2020), informed by data from Carter *et al.* (in prep) and Russell *et al.* (2017).

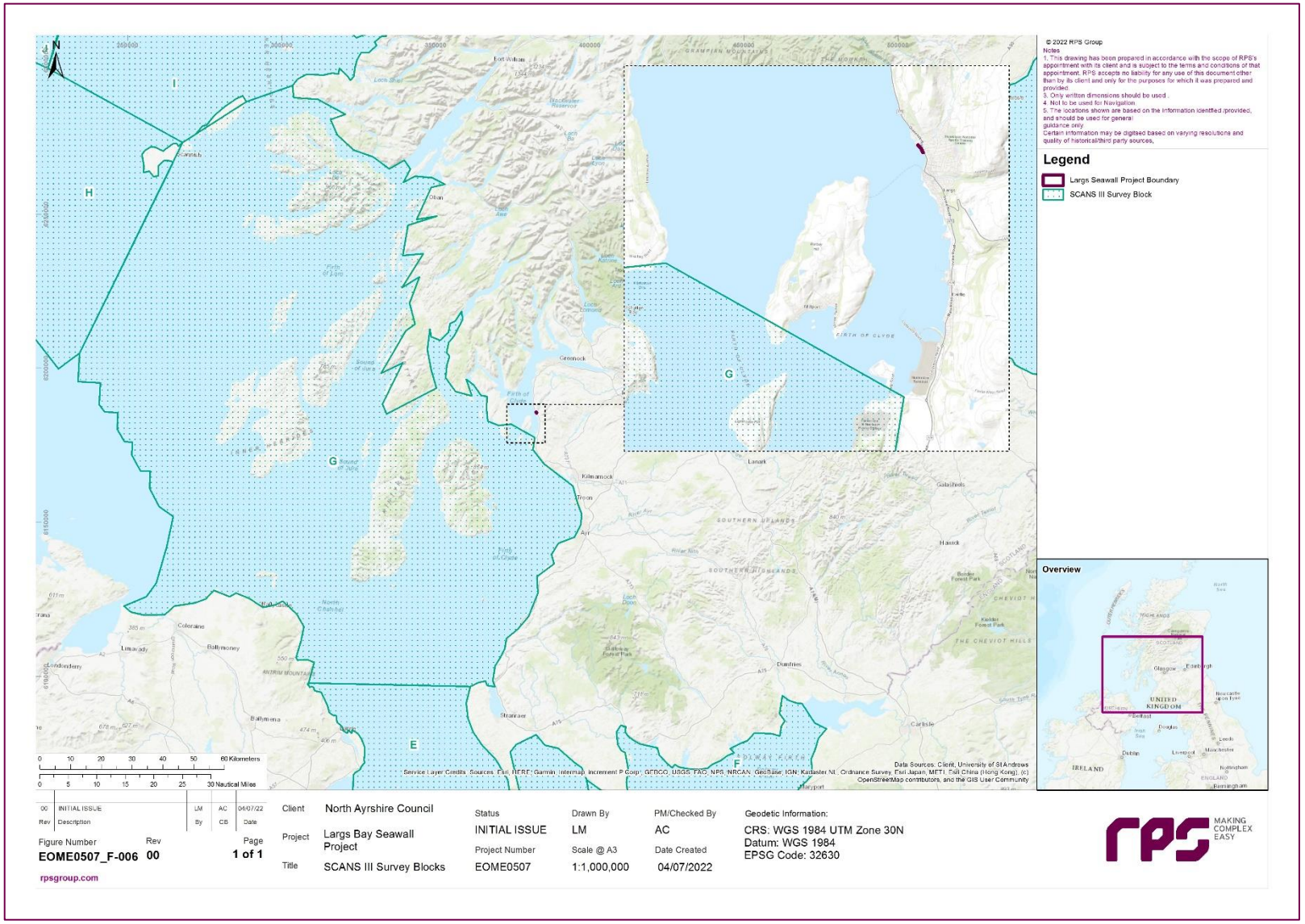


Figure 3.3: SCANS III Block G.

3.6 Marine Ornithology

3.6.1 Intertidal

Context in Relation to Designated Sites

The Inner Clyde SPA is located approximately 19 km from the project site. The SPA (which is also underlain by the Inner Clyde SSSI) hosts extensive saltmarsh habitats and is therefore important for over-wintering birds. Redshank *Tringa totanus* is the only qualifying feature in the Inner Clyde SPA (NatureScot, 2022b).

The notified ornithological features of the Inner Clyde SSSI are the following species of national or international importance: cormorant *Phalacrocorax carbo*, eider *Somateria mollissima*, goldeneye *Bucephala clangula*, oystercatcher *Haematopus ostralegus*, red-breasted merganser *Mergus serrator*, red-throated diver *Gavia stellata* and redshank *Tringa totanus* (Scottish Natural Heritage, 2010).

Survey results

In proximity to the Proposal, additional intertidal and nearshore ornithology surveys were conducted by RPS to identify areas which support significant numbers of qualifying species of designated sites and any areas which are important for large assemblages of birds (RPS, 2022b). Surveys were conducted between April and July 2021 inclusive with surveys covering a range of tidal conditions. The surveys noted that relatively low numbers of birds were present on the water located in front of the sea wall. Most birds present in surveys were also deemed to be common. Aggregations of birds were identified at the mouth of the Gogo Burn intertidal habitat. This is located near to the Proposal (400 m to the south), however it was deemed that due to the background levels of traffic and other activity in the area, disturbance to these species would not be significant.

Gulls were the most numerous species group identified during the surveys, with herring gull *Larus argentatus* present in the largest numbers (a peak count of 51 in Sector C for July 2021). The survey area was therefore considered of local importance for this species only. For all other species recorded, the survey area is of limited local importance, given the number of birds observed. Black guillemots *Cepphus grille* were also recorded during the surveys confirming their presence in the area.

Survey results identified a nesting pair of mute swans *Cygnus olor* within the survey area on the spit 100 m to the north of the Proposal. This spit was also used by other birds as a roost site. Twelve oyster catcher *Haematopus ostralegus* were recorded roosting there in July 2021, 8 great black-backed gulls *Larus marinus* were recorded in July 2021 and 5 common gull *Larus canus* were roosting there in April 2021.

For more information, see Intertidal and Nearshore Ornithology Surveys Report, presented alongside EIA screening.

3.6.2 Offshore

Context in Relation to Designated Sites

The primary seabird colonies are located off the Ayrshire Coast at Alisa Craig and the southeast coast of Kintyre at Sanda Island. These are both designated SSSIs for the protection of breeding seabirds. The cliffs and rocky shore of Alisa Craig are home to >10,000 pairs of breeding seabirds, including razorbill *Alca torda*, guillemot *Uria aalge*, kittiwake *Rissa tridactyla*, herring gull *Larus argentatus*, lesser black backed gull *Larus fuscus* and gannet *Morus bassanus*. The gannet colony at the site contributes to 10% of the British population (Scottish Natural Heritage, 2008). The Sanda Island SSSI is designated for the following breeding seabird species: black guillemot *Cepphus grille*, cormorant *Phalacrocorax carbo*, fulmar *Fulmarus glacialis*, great black-backed gull *Larus marinus*, guillemot *Uria aalge*, kittiwake *Rissa tridactyla*, Manx shearwater *Puffinus puffinus*, puffin *Fratercula arctica*, razorbill *Alca torda*, shag *Phalacrocorax aristotelis* and storm petrel *Hydrobates pelagicus*. The site hosts internationally important numbers of shag and razorbill (Scottish Natural Heritage, 2011).

Survey results

Intertidal and nearshore ornithology surveys were conducted by RPS to identify offshore areas (up to 1.5 km from shore) which support significant numbers of qualifying species of designated sites and any areas which are important for large assemblages of birds. Surveys were conducted between April and July 2021 inclusive with surveys covering a range of tidal conditions. The surveys noted that both the numbers and range of species were relatively low. With low numbers of birds present feeding and transiting offshore, therefore disturbance to these species would not be significant.

3.7 Invasive Non-Native Species

Introduction of Invasive Non-Native Species (INNS) for marine species can affect local populations, out complete species and affect ecosystems. These INNS can be introduced through natural or anthropogenic means, such as via imported rock, vessels or item of plant from other areas.

Within the Firth of Clyde, McIntyre *et al*. (2012), reported presence of cord-grass *Spartina anglica* which colonises shallow mudflats and competes with the native seagrass *Zostera noltii*. Furthermore, The Marine Scotland (2020) report on non-native species reported carpet sea squirt *Didemnum vexillum*, leathery sea squirt *Styela clava* and common cord-grass within the Clyde region of assessment.

The Firth of Clyde Biosecurity Plan 2012 – 2016 (Firth of Clyde Forum, 2016) details further INNS known to be established within the Firth of Clyde. These INNS are outlined in Table 3.3 below.

Table 3.3: INNS in the Firth of Clyde region (Firth of Clyde Forum, 2016)

INNS Species	Environmental Risk
A bryozoan (no common name) *Tricelleria inopinata*	Medium
A hydroid (no common name) *Cordylophora caspia*	Low
Acorn barnacle *Elminius modestus*	Low
An orange sheath tunicate (no common name) *Botrylloides violaceus*	Low
Carpet sea squirt *Didemnum vexillum*	High
Common cord-grass *Spartina anglica*	Medium
Green sea fingers *Codium fragile*	Low
Japanese skeleton shrimp *Caprella mutica*	Medium
Leathery sea squirt *Stela clava*	Low

INNS Species	Environmental Risk
Orange tipped sea squirt *Corella eumyota*	Low
Wireweed *Sargassum muticum*	Medium

4 EMBEDDED MITIGATION MEASURES

A number of embedded mitigation measures relevant to marine biodiversity are proposed to be incorporated into the design and construction method to manage the risk on the environment. These include:

1. Disturbance of intertidal zone outside existing sea wall footprint to be minimised where possible.

2. Rock will be washed down off site prior to installation (note, rock washed down at source).

3. Prior to construction, a Construction Environmental Management Plan (CEMP) will be produced by the appointed Contractor and submitted to MS-LOT for approval (if deemed necessary).

4. Adoption by the Contractor of Largs Yacht Haven's existing Oil Spill Contingency Plan (potentially as part of the EMP).

5. Sheet piling will be carried out in accordance with best practice guidance, and the use of vibratory pile installation will be maximised where possible.

6. Potential appointment of an appropriately qualified Environmental Clerk of Works with intertidal environmental experience, if deemed necessary by MS-LOT. Black guillemot *Cepphus grille* are known to nest within sea wall structures, it has therefore been recommended the pre-construction surveys should be carried out before the construction takes place to avoid infringement of the Wildlife and Countryside Act 1981 (as amended). If any breeding black guillemots are found, then advice of the Environmental Clerk of Works would need to be followed on site. However, given the nature of the current shoreline, the likelihood of nesting black guillemot is considered relatively low.

7. In order to limit spread of INNS, contractors will comply with the relevant Code of Practice and legislation. In addition to embedded mitigation measures outlined above further actions to prevent the spread of INNS will include:

    1. The 'check, clean, dry method' for all marine equipment, plant and vehicles between use; and
    2. Reporting any sightings of carpet sea squirt to the non-native species secretariat via: http://www.brc.ac.uk/risc/alert.php?species=carpet_seasquirt.

5 APPRAISAL OF EFFECTS

5.1 Approach

The following sections provide an appraisal of the potential implications of the licensable activities on receptors within the following environmental topics: Benthic Ecology; Fish and Shellfish, Marine Mammals and Marine Ornithology. Topics and their effects not considered within this appraisal are presented and discussed in Appendix C.

An appraisal has been undertaken of the licensable activities for each of the identified receptor groups described above, based on the potential effects identified in the Marine Biodiversity Desktop Literature Review (RPS, 2022a) during the project. Effects not considered as part of this Appraisal of Effects section are presented and discussed in Appendix C.

Each appraisal concludes whether the licensable activities are likely to result in a negligible, minor, moderate or major effect on the receptor. Consideration of the potential for Likely Significant Effect (LSE) on designated sites are presented within Section 7.

5.2 Benthic Ecology

5.2.1 Project design footprint leading to removal/disturbance of intertidal benthic habitats

No subtidal habitat is predicted to be affected due to all works being undertaken above MLWS.

Based on existing information provided in Section 3.3, intertidal benthic habitats that will be permanently removed as a consequence of the project include:

- *Fucus serratus* on moderately exposed lower eulittoral rock;
- *Lanice conchilega* in littoral sand;
- *Fucus spiralis* on sheltered variable salinity upper eulittoral rock;
- Talitrids on the upper shore and strand-line; and
- *Porphyra purpurea* and *Ulva* spp. on sand-scored mid or lower eulittoral rock present on the seawall.

The footprint area of the Proposal that will extend below MHWS has been calculated to be 2,343 m^2. While a variety of different biotopes will be removed by the project these types of habitat are considered to be common throughout the region and the removal of 2,343 m^2 of habitat is considered comparatively small. In addition, many of these biotopes listed above are only present on the existing sea wall. Once the new sea wall has been completed the biotopes are likely to recolonise.

In addition, it is likely the proposed rock armour placed within the intertidal areas will be colonised by similar characterising biotope species that will initially be removed by the Proposal.

The implication of the Proposal from permanent removal of benthic habitats has therefore been appraised as negligible.

5.2.2 Introduction of Invasive Non-Native Species (INNS) on benthic ecology

Plant, equipment and vehicles can act as a vector for INNS by allowing the colonisation of benthic species from other geographical areas either as marine fouling or incidentally present. All plant, equipment and vehicles will be required to follow the 'Check, Clean and Dry' method as outlined within the embedded mitigation measures prior to entering the marine environment.

Locally quarried rock armour material will be transferred to site by lorry. The material will be sourced in a non-marine area and will be transferred in dry conditions which will ensure non-native marine species will not be transferred.

In addition, an INNS risk assessment will be undertaken by the Contractor on award of contract. If it is identified there is a risk of INNS, then suitable additional mitigation will be implemented in line with best practice.

The implications from introduction of INNS from the Proposal on benthic ecology is therefore considered to be negligible.

5.3 Fish and Shellfish

5.3.1 Project design footprint leading to removal of potential fish feeding grounds

Species with spawning and nursery grounds that overlap with the Proposal include anglerfish, cod, common skate, European hake, herring, mackerel, sandeel, spurdog and whiting. Sandeel is recognised as a Priority Marine Feature. Diadromous fish species include the Atlantic salmon, river lamprey and European eel, may feed during their migration.

The footprint area of the Proposal that will extend below MHWS has been calculated to be 2,343 m^2. The construction works are intended to be undertaken along MHWS in the dry and likely to be covered by only a shallow amount of water during spring tides, resulting in an undesirable feeding ground that is predominately dry. It is unlikely that these works will result in disturbance to fish and shellfish within the area due to works being undertaken in the dry and the limited amount of time that this part of the intertidal will be inundated, and therefore available to fish.

The implications from removal of potential feeding grounds on Fish and Shellfish if therefore considered to be negligible.

5.3.2 Introduction for Invasive Non-Native Species (INNS) on fish and shellfish

Plant, equipment and vehicles can act as a vector for INNS by allowing the colonisation of benthic species from other geographical areas either as marine fouling or incidentally present. All plant, equipment and vehicles will be required to follow the 'Check, Clean and Dry' method as outline within the embedded mitigation measures prior to entering the marine environment.

Locally quarried rock armour material will be transferred to site by lorry. The material will be sourced in a non-marine area onshore and will be transferred in dry conditions which will ensure non-native marine species will not be transferred.

In addition, an INNS risk assessment will be undertaken by the Contractor on award of contract. If it is identified there is a risk of INNS, then suitable additional mitigation will be implemented.

The implications from introduction of INNS from the Proposal on Fish and Shellfish is therefore considered to be negligible.

5.4 Marine Mammals

Whilst cetaceans and pinnipeds have been identified with the Firth of Clyde, there is no pathway for an impact to occur to this receptor. As works are undertaken in the dry, no cetaceans will be affected by the works. The nearest pinniped haul out site is 30 km south of the project and whilst an individual pinniped may haul out in proximity to the works, there is unlikely to be any effect on the individual as the pinniped is likely to move away from area.

Works will be conducted in the dry, and therefore will not affect marine mammal species.

Effects not considered were screened out in the in the Marine Biodiversity Desktop Literature Review (RPS, 2022a). They have been reiterated in Appendix C for ease of reference.

5.5 Marine Ornithology

5.5.1 Development activities may result in disturbance to ornithological receptors

The Proposal will use large machinery which may have effects (e.g. disturbance) on intertidal bird populations. This will be temporary, short-term and reversible. The intertidal and nearshore ornithology surveys conducted between April and July 2021 inclusive revealed relatively low numbers of birds present on the open water in front of the Proposal, with species present being relatively common birds.

Birds were only consistently clustered at the mouth of the Gogo Burn, on the inter-tidal habitat there. Although this location is relatively close to the Proposal (400 m to the south), given the current background levels of traffic and other activity along the seafront, disturbance is not considered likely to be significant in the long term.

Gulls were the most numerous species group, with herring gull *Larus argentatus* present in largest numbers. The survey area is therefore considered of local importance for this species only. Herring gulls are habituated to people's activities and would not suffer significant disturbance effects from the Proposal. For all other species recorded, the survey area is of limited local importance.

Based on the survey results, there are no known black guillemot *Cepphus grille* nests and nests of other species in the survey area.

Works will be conducted during the summer (June to August 2023 inclusive), and therefore will not impact over-wintering bird species. The assessment has concluded that the Proposal will have a negligible effect on disturbance to Important Ornithological Features.

5.5.2 Development activities may result in potential loss of feeding grounds

In terms of Intertidal habitat during construction, the beach sediment (mainly sand) will be removed in the area of the new seawall and will be disposed of appropriately (e.g. reuse as beach renourishment or disposed of at a licensed disposal site).

The scour protection to the seaward side of the seawall will be placed on top of the existing beach material so nothing will be removed from this location, but the surface will have changed. The scour protection will be made up of rock armour and is anticipated to be quite small, similar to the size of cobbles/boulders on the beach at present (see section 2).

Once construction is complete there will be no permanent loss of habitat.

In terms of the offshore habitat, works will be conducted in the intertidal zone at low tide and will not interact with seabirds foraging at sea.

The assessment has concluded that the Proposal will have a negligible effect on feeding grounds for Important Ornithological Features.

6 CONSIDERATIONS OF OTHER PROJECTS

6.1 Screening of Projects

This section considers the potential for effects arising from the Proposal alongside other known activities. The Proposal is located adjacent to Largs Yacht Harbour which is an operating recreational fishing and leisure harbour. Activities may include vessel movements, maintenance dredging and are considered part of the baseline.

No other projects are currently being planned or being undertaken, therefore, there will be no implication on the environment.

7 HRA SCREENING

The location of the Proposal in relation to the designated sites, which include SACs and SPAs, identified in Section 3.2 is shown in Figure 3.1. The need to consider the potential for Likely Significant Effect (LSE) on these sites from the Proposal is discussed below.

7.1 Renfrewshire Heights SPA

The hen harrier *Circus cyaneus* feature of the Renfrewshire Heights SPA is assessed as "unfavourable, declining" (NatureScot, 2022a).

Renfrewshire Heights SPA lies 4 km north east of the Proposal. As hen harriers *Circus cyaneus* tend to hunt for prey within upland and lowland areas and are unlikely to be found in highly developed urbanised coastal areas, there will be no loss of feeding grounds. Therefore, the potential for the activities to result in negative effects on hen harrier as features of the Renfrewshire Heights SPA is considered to be negligible.

Therefore, there is no potential for LSE on qualifying features arising from any of the effects identified in this appraisal either alone or in-combination with any other projects or aspects of the Proposal.

7.2 Inner Clyde SPA

Inner Clyde SPA lies 19 km north east of the Proposal. Redshank *Tringa totanus* is the only qualifying feature in the Inner Clyde SPA (NatureScot, 2022b). Redshank *Tringa totanus* were not recorded during the survey. Therefore, there is no potential for LSE on qualifying features arising from any of the effects identified in this appraisal either alone or in-combination with any other projects or aspects of the Proposal.

7.3 Arran Moors SPA

The hen harrier *Circus cyaneus* feature of the Arran Moors SPA is assessed as "favourable, maintained" (NatureScot, 2022c).

As highlighted in 7.1, Arran Moors SPA lies 23 km south west of the Proposal. As hen harriers *Circus cyaneus* tend to hunt for prey within upland and lowland areas and are unlikely to be found in highly developed urbanised coastal areas, there will be no loss of feeding grounds. Therefore, the potential for the activities to result in negative effects on hen harrier *Circus cyaneus* as features of the Arran Moors SPA is considered to be negligible.

Therefore, there is no potential for LSE on qualifying features arising from any of the effects identified in this appraisal either alone or in-combination with any other projects or aspects of the Proposal.

7.4 Loch Lomond SPA

The capercaillie *Tetrao urogallus* feature of the Loch Lomond SPA is assessed as "unfavourable declining" (NatureScot, 2022d).

Loch Lomond SPA lies 35 km north east of the Proposal. The capercaillie *Tetrao urogallus* is a woodland grouse and is highly unlikely to be found with the Proposal area. Therefore, the potential for the activities to result in negative effects on capercaillie *Tetrao urogallus* as features of the Loch Lomond SPA is considered to be very unlikely.

Therefore, there is no potential for LSE on qualifying features arising from any of the effects identified in this appraisal either alone or in-combination with any other projects or aspects of the Proposal.

7.5 Sounds of Gigha SPA

Great northern diver *Gavia immer*, Slavonian grebe *Podiceps auratus*, common eider *Somateria mollissima* and red-breasted merganser *Mergus serrator* are all qualifying features of the Sounds of Gigha SPA (NatureScot, 2022e).

Sounds of Gigha SPA lies 36 km west of the Proposal. There were no great northern diver *Gavia immer* or Slavonian grebe *Podiceps auratus* recorded and only 9 common eider *Somateria mollissima* and 1 red-breasted merganser *Mergus serrator*. The connectivity range for common eider *Somateria mollissima* is beyond the 36 km distance from the Sounds of Gigha SPA, at 80 km (Thaxter *et al.,* 2012). Even assuming red-breasted merganser *Mergus serrator* were SPA connected birds, given the localised, reversible and negligible disturbance activity, the potential for the activities to result in negative effects on ornithological receptors as features of the Sounds of Gigha SPA is considered to be negligible.

Therefore, there is no potential for LSE on qualifying features arising from any of the effects identified in this appraisal either alone or in-combination with any other projects or aspects of the Proposal.

7.6 Endrick Water SAC

The Atlantic salmon, brook lamprey and river lamprey features of the Endrick Water SAC are assessed as “Favourable, maintained”, with the exception of the Atlantic salmon as assessed as “unfavourable, recovering” (SNH, 2019f).

The Endrick Water SAC is located 37 km north east of the Proposal. Whilst there may be some potential for the diadromous fish citation species to be in the area, feeding grounds are highly unlikely to be affected as the Proposal is to be undertaken in the dry and along the MHWS line. In addition, the distance from the Proposal, combined with evidence to suggest that migrating Atlantic salmon smolts move rapidly out to sea rather than staying close to the coastline (Newton *et al*., 2017) also suggests salmon migrating past the Proposal are unlikely to be in the area for long or in great numbers. Adult river and brook lamprey mainly stay within estuarine areas (Maitland, 2003) and are therefore unlikely to migrate up the coast towards the Proposal and are unlikely to be affected by the works during their sea going phase.

The potential for the activities to result in negative effects on the features of the Endrick Water SAC is considered to be negligible. Therefore, there is no potential for LSE on qualifying features arising from any of the effects identified in this appraisal either alone or in-combination with any other projects or aspects of the Proposal.

7.7 Muirkirk and North Lowther Uplands SPA

The golden plover *Pluvialis apricaria* (unfavourable, declining), hen harrier *Circus cyaneus* (unfavourable, declining), merlin *Falco columbarius* (unfavourable, no change), peregrine *Falco peregrinus* (unfavourable, no change), and short-eared owl *Asio flammeus* (favourable, maintained) are features of the Muirkirk and North Lowther Uplands SPA (NatureScot, 2022g).

Muirkirk and North Lowther Uplands SPA lies 43 km south east of the Proposal. Given the lack of suitable habitat and that the Proposal is beyond connectivity distances for all SPA qualifying species, the potential for the activities to result in negative effects on ornithological receptors as features of the Muirkirk and North Lowther Uplands SPA is considered to be negligible.

Therefore, there is no potential for LSE on qualifying features arising from any of the effects identified in this appraisal either alone or in-combination with any other projects or aspects of the Proposal.

7.8 Inner Hebrides and the Minches SAC

The most recent status assessment of the harbour porpoise population of the Inner Hebrides and the Minches SAC is “favourable, maintained” (SNH, 2022h).

Inner Hebrides and the Minches SAC lies 45 km north west of the Proposal. Effects on marine mammals were screened out on the basis that there was no effect pathway (RPS, 2022a). Therefore, there is no potential for LSE on qualifying features arising from any of the effects identified in this appraisal, either alone or in-combination with any other projects or aspects of the Proposal.

7.9 Moine Mhor SAC

Otter are features of the Moine Mhor SAC and assessed as “favourable, maintained” (SNH, 2022i).

Moine Mhor SAC lies 48 km north west of the Proposal. Effects on marine mammals were screened out on the basis that there was no effect pathway (RPS, 2022a). Otters are usually found along rivers and whilst known to feed at sea, they are unlikely to be affected by the Proposal due to already existing anthropogenic disturbance. Further, at this distance if otters are present in the vicinity of the Proposal, these are highly unlikely to be associated with the Moine Mhor SAC. Therefore, there is no potential for LSE on qualifying features arising from any of the effects identified in this appraisal, either alone or in-combination with any other projects or aspects of the Proposal.

7.10 Taynish and Knapdale Woods SAC

Otter are features of the Taynish and Knapdale Woods SAC and assessed as “favourable, maintained” (SNH, 2022j).

Taynish and Knapdale Woods SAC lies 50 km north west of the Proposal. Effects on marine mammals were screened out on the basis that there was no effect pathway (RPS, 2022a). Otters are usually found along rivers and whilst known to feed at sea, they are unlikely to be affected by the Proposal due to already existing anthropogenic disturbance. Further, at this distance if otters are present in the vicinity of the Proposal, these are highly unlikely to be associated with the Moine Mhor SAC. Therefore, there is no potential for LSE on qualifying features arising from any of the effects identified in this appraisal, either alone or in-combination with any other projects or aspects of the Proposal

8 SUMMARY OF EFFECTS

A description, summary and assessment of the impact scenarios presented in this Environmental Appraisal is provided in Table 8.1.

Table 8.1: Description, summary and assessment of impact scenarios.

Description of Potential Effect	Appraisal of Effects	Conclusion of Appraisal
Benthic Ecology		
Proposal footprint leading to removal/ disturbance of intertidal benthic habitats	Excavation of material is likely to remove associated benthic communities. However, biotopes present are considered common and it is likely that following excavation and placement of rock armour that the rock armour will be quickly recolonised.	Negligible
Introduction for Invasive Non-Native Species (INNS) on benthic ecology	INNS may be introduced or spread from site due to the presence of marine vectors, such as plant or equipment. However, all plant and equipment arriving on site will follow the 'Clean, Check and Dry' method. Additionally, an INNS risk assessment will be undertaken as part of embedded mitigation to assess the risk of introduction or spread of INNS.	Negligible
Fish and Shellfish		
Project design footprint leading to removal of potential feeding grounds	Fish and shellfish species with feeding grounds within the area may have their feeding grounds removed due to habitat removal. However, excavation of material is to occur along MHWS and in the dry, whereby fish and shellfish are unlikely to feed.	Negligible
Introduction for INNS on fish and shellfish	INNS may be introduced or spread from site due to the presence of marine vectors, such as plant or equipment. However, all plant and equipment arriving on site will follow the 'Clean, Check and Dry' method. Additionally, an INNS risk assessment will be undertaken as part of embedded mitigation to assess the risk of introduction or spread of INNS.	Negligible
Marine Ornithology		
Development activities may result in disturbance to ornithological receptors	As the Proposal is expected to be undertaken in the summer when over-wintering birds are not present, no significant effect from disturbance is predicted.	Negligible
Development activities may result in potential loss of feeding grounds	There will be some temporary habitat loss with the Proposal through the removal of beach sediment in the area of the new sea wall. The scour protection to the seaward side of the seawall will be placed on top of the existing beach material so nothing will be removed from this location, but the surface will have changed. No significant effect from loss of feeding grounds is predicted.	Negligible

9 REFERENCES

Baxter, J.M., Boyd, I.L., Cox, M., Donald, A.E., Malcolm, S.J., Miles, H., Miller, B., and Moffat, C.F., (Editors), (2011). Scotland's Marine Atlas: Information for the national marine plan. Marine Scotland, Edinburgh. pp. 191BOWL (2012) Beatrice Offshore Wind Farm Environmental Statement. April 2012.

BGS (2019). Geology Viewer. Available online: BGS Geology Viewer (BETA).

Carter, M. I. D., Boehme, L., Duck, C. D., Grecian, J., Hastie, G. D., McConnell, B. J., Miller, D. L., Morris, C., Moss, S., Thompson, D., Thompson, P., & Russell, D. JF. (2020). Habitat-based predictions of at-sea distribution for grey and harbour seals in the British Isles: Report to BEIS, OESEA-16-76, OESEA-17-78. Sea Mammal Research Unit, University of St Andrews.

Connor, D. W., & Little, M. (1998). Clyde Sea (MNCR Sector 12). *Marine Nature Conservation Review. Benthic marine ecosystems of Great Britain and the north-east Atlantic*, 339-353.

Coull, K.A., Johnson, R. and Rodgers, S.I., (1998). Fisheries sensitivity Maps in British Waters. Published Distribution by UKOOA Ltd.

Dipper, F., (2001). British sea fishes (2nd edn). Teddington: Underwater World Publications Ltd.

Eleftheriou, A., & McIntyre, A. D. (1976). The intertidal fauna of sandy beaches. A survey of the Scottish coast. Available from the National Technical Information Service, Springfield VA 22161 as PB-267 959, Price codes: A 04 in paper copy, A 01 in microfiche. 1976. 65 p, 23 tab, 15 ref.

Ellis, J.R., Milligan, S.P., Readdy, L., Taylor, N. and Brown, M.J., (2012). Spawning and nursery grounds of selected fish species in UK waters. Sci. Ser. Tech. Rep., Cefas Lowestoft, 147: 56 pp.

Evans, P. G. H., Baines, M. E., and Coppock, J., (2011). Abundance and behaviour of cetaceans and basking sharks in the Pentland Firth and Orkney waters (Report by Hebog Environmental Ltd & Sea Watch Foundation, Scottish Natural Heritage Commissioned Report No. 419).

Firth of Clyde Forum. (2016). Firth of Clyde Biosecurity Plan 2012 – 2016. Available online: https://www.clydemarineplan.scot/wp-content/uploads/2016/05/FoCF-Biosecurity-plan.pdf. Accessed March 2022.

Hague, E. L., Sinclair, R. R., & Sparling, C. E. (2020). Regional baselines for marine mammal knowledge across the North Sea and Atlantic areas of Scottish waters. Scottish Marine and Freshwater Science.

Hall-Spencer, J. M. (1995). The effects of scallop dreding on maerl beds in the Firth of Clyde. Porcupine Newsletter 6 (1): 16-27.

Hall-Spencer, J. M., & Moore, P. G. (2000). Scallop dredging has profound, long-term impacts on maerl habitats. ICES Journal of marine science, 57(5), 1407-1415.

Hammond, P. S., Lacey, C., Gilles, A., Viquerat, S., Börjesson, P., Herr, H., ... & Øien, N. (2017). Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys. Wageningen Marine Research.

Heath, M. R., & Speirs, D. C. (2012). Changes in species diversity and size composition in the Firth of Clyde demersal fish community (1927–2009). Proceedings of the Royal Society B: Biological Sciences, 279(1728), 543-552.

Kamenos, N. A., Moore, P. G., & Stevenson, T. D. I. (2004). Marine survey to identify maerl beds: Lamlash Bay long sea outfall. Scottish Water Solutions Ref Num: SWS. FW/2004–0427-01. University Marine Biological Station Millport, Isle of Cumbrae.

Laist D.W., Knowlton A.R., Mead J.G., Collet A.S., Podesta M. (2001). Collisions between ships and whales. Marine Mammal Science 17:35-75.

Lockwood 2005. Strategic Environmental Assessment of the fish and shellfish resources with respect to proposed offshore wind farms in the eastern Irish Sea

Maitland, P.S. (2003). Ecology of the River, Brook and Sea Lamprey. Conserving Natura 2000 Rivers Ecology Series No. 5. English Nature, Peterborough.

Marine Scotland (2019). MAPS NMPi. https://marinescotland.atkinsgeospatial.com/nmpi/.

Marine Scotland (2020). Non-native species. Available online: Non-native species | Scotland's Marine Assessment 2020.

Marine Scotland (2021). Clyde Scottish Marine Region. Available online: Clyde SMR | Scotland's Marine Assessment 2020

McIntrye, F., Fernandes, P. G., & Turrell, W. R. (2012). *Clyde ecosystem review*. Scottish Government.

McIntyre, P. Hansen G, Vander Zanden, M, Blum, M.J, Clayton, M.K, Hain, E.F. (2013) Commonly Rare and Rarely Common: Comparing Population Abundance of Invasive and Native Aquatic Species. 8(10): pp.77415.

NatureScot (2022). Atlantic Salmon. Available online: Atlantic salmon | NatureScot.

NatureScot (2022a). Site Details for Renfrewshire Heights SPA, Available at: SiteLink (nature.scot).

NatureScot (2022b). Site Details for Inner Clyde SPA, Available at: SiteLink (nature.scot)

NatureScot (2022c). Site Details for Arran Moors SPA, Available at: SiteLink (nature.scot)

NatureScot (2022d). Site Details for Loch Lomond SPA, Available at: SiteLink (nature.scot)

NatureScot (2022e). Site Details for Sounds of Gigha SPA, Available at: SiteLink (nature.scot)

NatureScot (2022g). Site Details for Muirkirk and North Lowther Uplands SPA, Available at: SiteLink (nature.scot)

NBN Atlas (2022). Interactive Maps. Available online: Species search | NBN Atlas.

Newton, M., Main, R. and Adams, C. (2017). Atlantic Salmon Salmo salar smolt movements in the Cromarty and Moray Firths, Scotland. LF000005-REP-1854, March 2017.

Russell, D. J. F., Jones, E. L., & Morris, C. D. (2017). Updated seal usage maps: the estimated at-sea distribution of grey and harbour seals. *Scottish Marine and Freshwater Science*, *8*(25), 25.

RPS (2022a). Marine Biodiversity Desktop Literature Review. Available online: largs_screening_request_may_2022_redacted.pdf (marine.gov.scot).

RPS (2022b). Largs Sea Wall. Intertidal and Nearshore Ornithology Surveys Report.

Saunders, G., Bedford, G.S., Trendall, J.R., and Sotheran, I. (2011). Guidance on survey and monitoring in relation to marine renewables deployments in Scotland. Volume 5. Benthic Habitats. Unpublished draft report to Scottish Natural Heritage and Marine Scotland.

SCOS. (2020(. Scientific Advice on Matters Related to the Management of Seal Populations: 2019.

Scottish Government (2020). Non-native species. Available at: https://marine.gov.scot/sma/sites/default/files/sma2020_-_non-native_species_-healthy_and_biologically_diverse.pdf. [Accessed: March 2022]

Scottish Government (2021). Scottish Marine and Freshwater Science Volume 3 Number 3: Clyde Ecosystem Review. Available online: 4. BIODIVERSITY - Scottish Marine and Freshwater Science Volume 3 Number 3: Clyde Ecosystem Review - gov.scot (www.gov.scot).

Scottish Natural Heritage (2022f). Site Details for Endrick Water SAC, Available at: SiteLink (nature.scot)

Scottish Natural Heritage (2022h). Site Details for Inner Hebrides and the Minches SAC, Available at: SiteLink (nature.scot)

Scottish Natural Heritage (2022i). Site Details for Moine Mhor SAC, Available at: SiteLink (nature.scot)

Scottish Natural Heritage (2022j). Site Details for Taynish and Knapdale Woods SAC, Available at: SiteLink (nature.scot)

Scottish Natural Heritage (2008). Alisa Craig Site of Special Scientific Interest Citation. Available at: https://sitelink.nature.scot/site/22 Accessed March 2022.

Scottish Natural Heritage (2010). Inner Clyde Site of Special Scientific Interest – Site Management Statement. Available at: https://apps.snh.gov.uk/sitelink-api/v1/sites/1701/documents/1#:~:text=The%20Inner%20Clyde%20Site%20of,as%20Mean%20Low%20Water%20Springs. Accessed March 2022.

Scottish Natural Heritage (2011). Sanda Islands Site of Special Scientific Interest Citation. Available at: https://sitelink.nature.scot/site/1402 Accessed March 2022.

SeaWatch Foundation (2020) South West Scotland and Inner Hebrides Recent Cetacean signthigns. Available at: https://seawatchfoundation.org.uk/legacy_tools/region.php?output_region=13 [Accessed April 2022]..

Thaxter, C. B., Lascelles, B., Sugar, K., Cook, A.S.C.P., Roos, S., Bolton, M., Langston, R.H.W., and Burton, N.H.K. (2012). Seabird foraging ranges as a preliminary tool for identifying candidate Marine Protected Areas. *Biological Conservation,* 156, pp. 53–61

Appendix A - Design Drawings

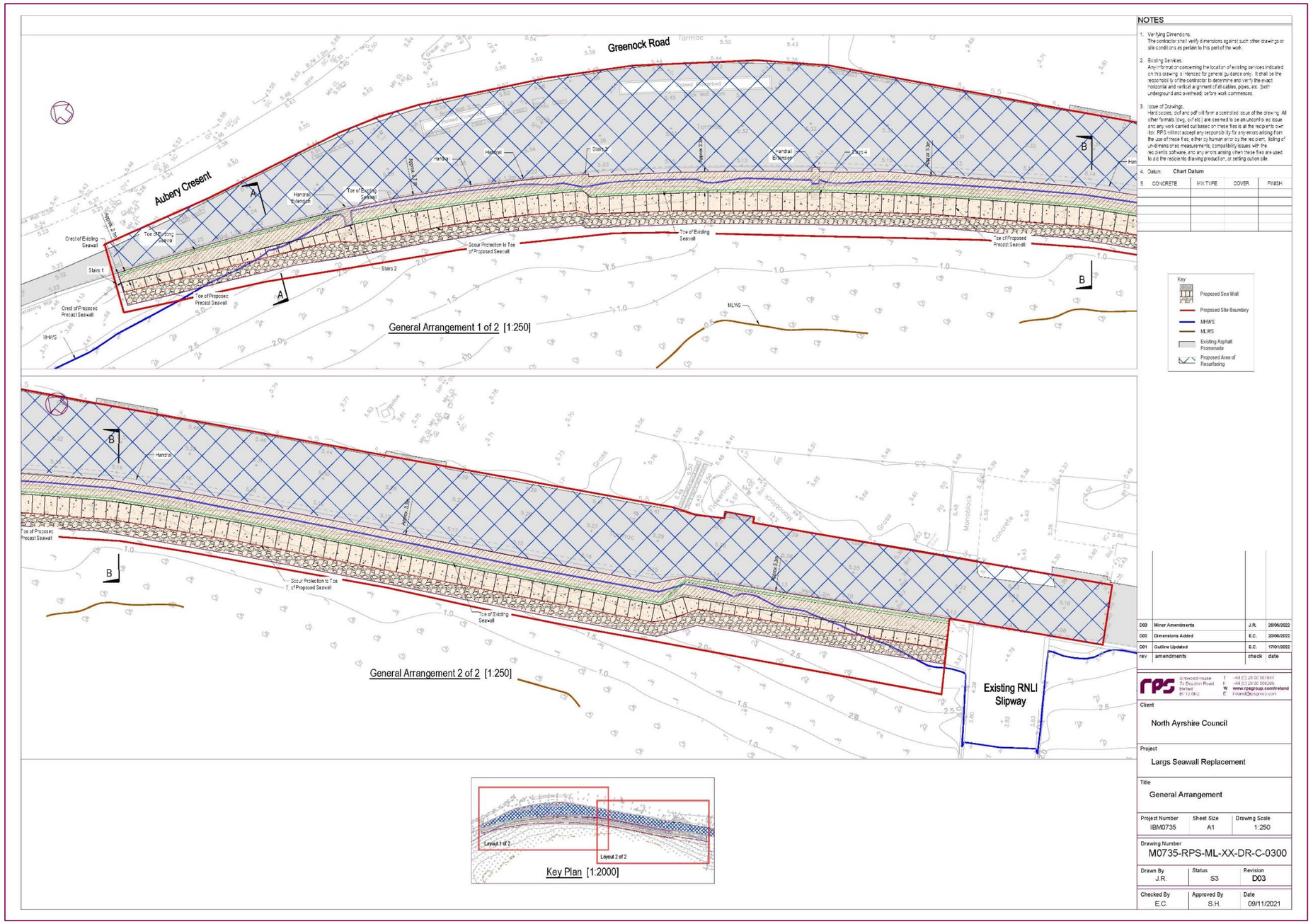
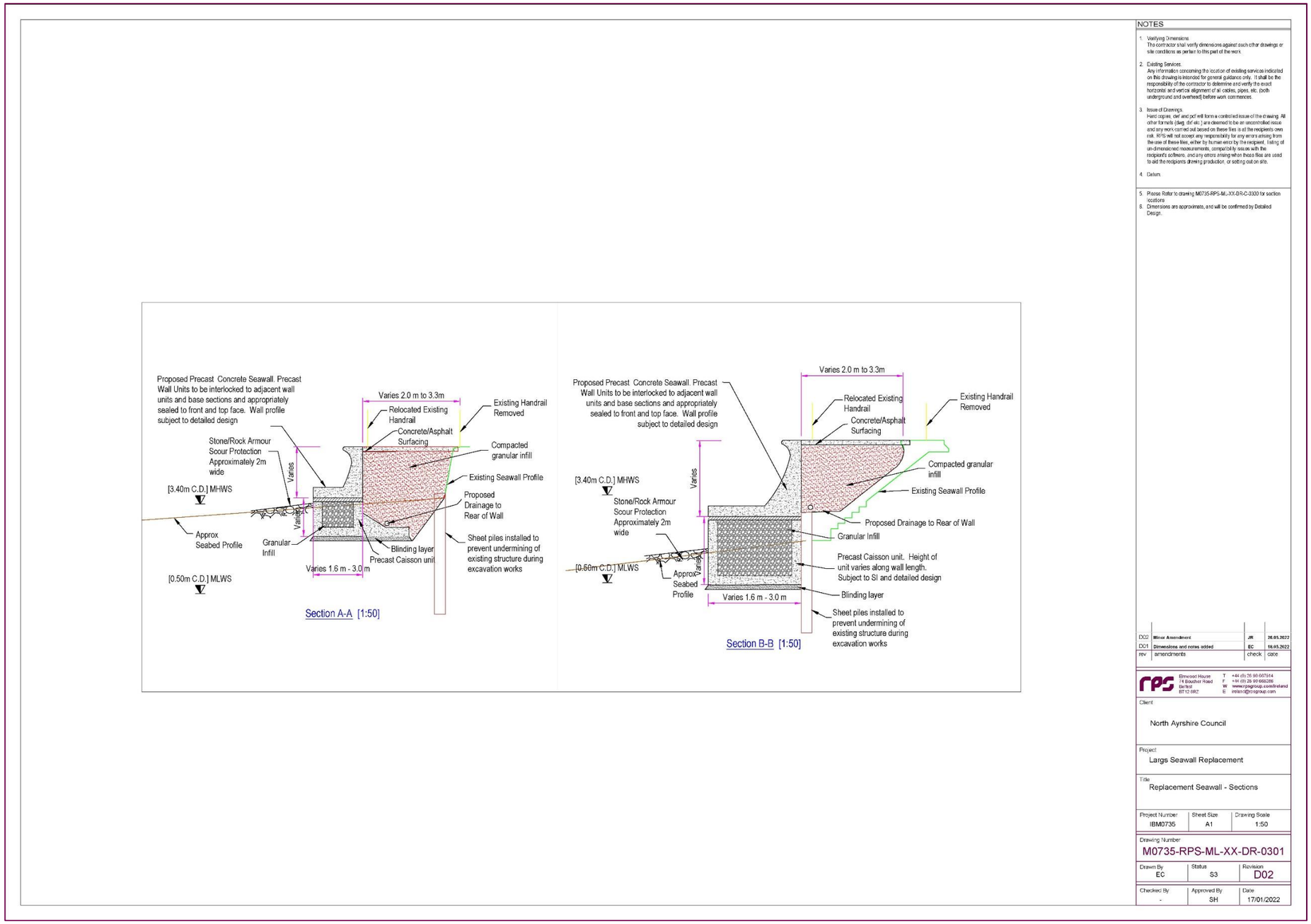


Figure 9.1: Proposed layout of the sea wall replacement.



NOTES

1. Verifying Dimensions
   The contractor shall verify dimensions against such other drawings or site conditions as pertain to this part of the work.
2. Existing Services.
   Any information concerning the location of existing services indicated on this drawing is intended for general guidance only. It shall be the responsibility of the contractor to determine and verify the exact horizontal and vertical alignment of all cables, pipes, etc. (both underground and overhead) before work commences.
3. Issue of Drawings.
   Hard copies, dwf and pdf will form a controlled issue of the drawing. All other formats (dwg, dxf etc.) are deemed to be an uncontrolled issue and any work carried out based on these files is at the recipients own risk. RPS will not accept any responsibility for any errors arising from the use of these files, either by human error by the recipient, listing of un-dimensioned measurements, compatibility issues with the recipient's software, and any errors arising when these files are used to aid the recipients drawing production, or setting out on site.
4. Datum.
5. Please Refer to drawing M0735-RPS-ML-XX-DR-C-0300 for section locations
6. Dimensions are approximate, and will be confirmed by Detailed Design.

rev	amendments	check	date
D02	Minor Amendment	JR	20.05.2022
D01	Dimensions and notes added	EC	18.05.2022

RPS
Elmwood House
74 Boucher Road
Belfast
BT12 6RZ
T +44 (0) 28 90 667914
F +44 (0) 28 90 666288
W www.rpsgroup.com/ireland
E ireland@rpsgroup.com

Client: North Ayrshire Council

Project: Largs Seawall Replacement

Title: Replacement Seawall - Sections

Project Number	Sheet Size	Drawing Scale
IBM0735	A1	1:50

Drawing Number: M0735-RPS-ML-XX-DR-0301

Drawn By	Status	Revision
EC	S3	D02

Checked By	Approved By	Date
-	SH	17/01/2022

Figure 9.2: Cross sections of the seawall.

Appendix B – Plant and Materials

Plate 4 to Plate 9 provide typical examples of the plant and equipment that will be used during the proposed works.

Plate 4: Excavator unloading from dump truck.

Plate 5: HGV lorries for delivery of locally sourced rock armour.

Plate 6: Loading shovel/telehandler.

Plate 7: a crane for lifting units/armour into place or clearing existing sea wall.

Plate 8: Concrete wagon.

Plate 9: Articulated Dumper Truck.

Appendix C – Screening Exercise

Receptor groups not considered for further appraisal

Table A1 below provides a summary of the receptor topics that have been scoped out including a brief justification, see Marine Biodiversity Desktop Literature Review (RPS, 2022a). Effects that have not been considered for further appraisal for each receptor topic and a justification have also been provided below.

Benthic Ecology

Effects to benthic ecology that have not been considered further for appraisal include:

- Preparation of the toe trench and placement of rock may cause an increase in suspended sediment concentrations and associated sediment deposition.

Increases in suspended sediment concentrations has the potential to cause light attenuation at the seabed which can restrict the ability of species to photosynthesise. Smothering of benthic species from sediment deposition can also occur as sediments fall out of suspension following disturbance. However, these potential effects have been screened out from further consideration as the material that will be removed to develop the toe trench will be of a very small volume, will be removed over a short period and in the dry.

- Placement of rock may cause a temporary increase in suspended sediment concentration (SSC) and associated sediment deposition.

Increases in SSC has the potential to cause light attenuation at the seabed which can restrict the ability of species to photosynthesise. In addition, as mobilised sediments fall out of suspension and undergo deposition on the seabed effects on benthic species from smothering maybe possible. This potential effect has been screened out from further consideration based on the volume of fine sediment residue attached to the rock used for the Proposal which will be very small and following interaction with the sea will dilute rapidly through wave action and tidal currents resulting in elevated suspended sediments for a short period of time within a localised area.

- Sediment disturbances leading to the release of sediment contaminants and consequent toxic effects on benthic species.

The material to be removed from the toe trench will likely consist of coarse sediments and rock which do not have affinity to bond with contaminants, unlike clay and silt sediments. Furthermore, all materials placed during construction are inert or harden very quickly and will not result in release of contaminants into the water column. Given the volume of material to be removed, low levels of contaminants likely contained within the material and that all works will be undertaken in the dry, there is no pathway for this to affect benthic intertidal habitats, species or communities.

- Project activities may result in accidental release of pollutants leading to toxic effects on benthic species.

The potential for accidental release of pollutants affecting benthic ecology receptors has been screened out of further consideration on the basis of the designed-in mitigation measures which include pollution prevention and control measures which will reduce the likelihood of effect to a negligible level.

Fish

Effects to fish that have not been considered further for appraisal include:

- Preparation of the toe trench and placement of rock may cause an increase in suspended sediment concentrations and associated sediment deposition.

Increases in SSC has the potential to cause light attenuation at the seabed which can restrict the ability of species to photosynthesise. In addition, as mobilised sediments fall out of suspension and undergo deposition on the seabed effects on benthic species from smothering maybe possible. This potential effect has been screened out from further consideration based on the volume of fine sediment residue attached to the rock used for the Proposal which will be very small and following interaction with the sea will dilute rapidly through wave action and tidal currents resulting in elevated suspended sediments for a short period of time within a localised area.

- Sediment disturbances leading to the release of sediment contaminants and consequent toxic effects on benthic species.

The material to be removed from the toe trench will likely consist of coarse sediments and rock which do not have affinity to bond with contaminants, unlike clay and silt sediments. Furthermore, all materials placed during construction are inert or harden very quickly and will not result in release of contaminants into the water column. Given the volume of material to be removed, low levels of contaminants likely contained within the material and that all works will be undertaken in the dry, there is no pathway for this to affect fish and shellfish.

- Project activities may result in accidental release of pollutants leading to toxic effects on fish.

The potential for accidental release of pollutants affecting fish and shellfish receptors has been screened out of further consideration on the basis the designed-in mitigation measures which include pollution prevention and control measures reduce the likelihood of impact to a negligible level.

- Project development activities may result in noise emissions leading to disturbance to fish.

The Proposal activities such as installation of sheet piles, rock placement, beach excavation and seawall excavation has the potential to generate underwater noise. However, the works will be carried out at low-tide in the dry, there will be no water on the beach and therefore no medium through which underwater noise may be propagated to the marine environment such that would represent a risk of injury of disturbance to fish and shellfish species.

Marine Mammals

Impacts to marine mammals that have been scoped out from further assessment include:

- Project development activities may result in noise emissions leading to disturbance to marine mammals.

The Proposal activities such as installation of sheet piles, rock placement, beach excavation and seawall excavation have the potential to generate underwater noise. However, the works will be carried out at low-tide in the dry on the beach therefore there will be no water. Therefore, no medium through which underwater noise may be propagated to the marine environment such that would represent a risk of injury of disturbance to marine mammal species.

- Vessel traffic associated with the Proposal may result in collision risk.

No vessels are proposed to be used to construct the sea wall. All works will be undertaken from the shore.

Appendix D

Intertidal and Nearshore Ornithology Surveys

LARGS SEA WALL

Intertidal and Nearshore Ornithology Surveys

ECO01851
v1
11 January 2022

rpsgroup.com

Document status

Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
1	Draft	Katy Thomas	Dr. Simon Zisman	Dr. Simon Zisman	10 Jan 2022

Approval for issue

Dr. Simon Zisman	[redacted]	10 January 2022

The report has been prepared for the exclusive use and benefit of our client and solely for the purpose for which it is provided. Unless otherwise agreed in writing by RPS Group Plc, any of its subsidiaries, or a related entity (collectively 'RPS') no part of this report should be reproduced, distributed or communicated to any third party. RPS does not accept any liability if this report is used for an alternative purpose from which it is intended, nor to any third party in respect of this report. The report does not account for any changes relating to the subject matter of the report, or any legislative or regulatory changes that have occurred since the report was produced and that may affect the report.

The report has been prepared using the information provided to RPS by its client, or others on behalf of its client. To the fullest extent permitted by law, RPS shall not be liable for any loss or damage suffered by the client arising from fraud, misrepresentation, withholding of information material relevant to the report or required by RPS, or other default relating to such information, whether on the client's part or that of the other information sources, unless such fraud, misrepresentation, withholding or such other default is evident to RPS without further enquiry. It is expressly stated that no independent verification of any documents or information supplied by the client or others on behalf of the client has been made. The report shall be used for general information only.

Prepared by:

RPS

Dr. Simon Zisman
Senior Director

Atholl Exchange
1st Floor, 6 Canning Street
Edinburgh, EH3 8EG

T +44 [redacted]
E [redacted]

Prepared for:

North Ayrshire Council

Contents

1 INTRODUCTION 1
1.1 Purpose and Scope of the Report 1
1.2 Designated Sites 1

2 METHODOLOGY 2
2.1 Intertidal and Nearshore Coastal Surveys 2

3 RESULTS 3
3.1 Intertidal and Nearshore Ornithology Data 3
3.1.1 Waterfowl 3
3.1.2 Wading Birds 4
3.1.3 Gulls and Terns 4
3.1.4 Other Seabirds 5

4 SUMMARY AND CONCLUSIONS 7

Tables

Table 1.1: Designated Sites with Ornithological Interest within a 20km Search Radius 1
Table 2.1: Intertidal and Nearshore Coastal Bird Survey Effort 2
Table 3.1: Total Monthly Counts and Peak Total Monthly Counts of Waterfowl Recorded within each Survey Sector between April and July 2021 3
Table 3.2: Total Monthly Counts and Peak Total Monthly Counts of Wading Birds Recorded within each Survey Sector between April and July 2021 4
Table 3.3: Total Monthly Counts and Peak Total Monthly Counts of Gulls and Terns Recorded within each Survey Sector between April and July 2021 5
Table 3.4: Total Monthly Counts and Peak Total Peak Counts of other Seabirds Recorded within each Survey Sector between April and July 2021 5

Figures

Figure 1: Ornithological Designated Sites within 20km
Figure 2: Survey Area and Count Sectors
Figure 3: Survey Results

1 INTRODUCTION

1.1 Purpose and Scope of the Report

RPS was commissioned by North Ayrshire Council to undertake intertidal and nearshore ornithological surveys of the intertidal and nearshore area adjacent to Largs.

The Promenade at Largs seafront extends from Largs Harbour at the south to the mouth of the Noddsdale Water at the north, with a wall along the seaward length of the promenade, transitioning to a sea wall from the Royal National Lifeboat Institution (RNLI) slipway for approximately 300m north.

The existing seawall at Largs retains the promenade and protects the shore side buildings and infrastructure from wave action and coastal erosion. However recent surveys have indicated that the existing seawall structure is deteriorating through concrete deterioration and undermining.

The proposed seawall replacement scheme comprises the replacement/encapsulation of the existing 300m long seawall and would include:

The main objectives of the intertidal and nearshore ornithological surveys and desk studies were therefore to identify:

- Any areas which support significant numbers of qualifying species of the various coastal/marine designated sites in the relevant Special Protection Areas (SPAs); or
- Any areas which are of importance for large assemblages of birds.

Therefore, the purpose of this report is to present the key findings of the intertidal and nearshore ornithological surveys that were undertaken between April and July 2021, to help inform mitigation measures required in order to ensure compliance with relevant wildlife legislation.

1.2 Designated Sites

A search area of 20km was used to identify designated sites with ornithological interest with connectivity to the site. The results are shown in Table 1.1. Their locations shown on Figure 1.

A total of three Sites of Special Scientific Interest (SSSIs) and one Special Protected Area (SPA) designated for their ornithological interest were identified within the search radius. However, based on their distance and limited connectivity to the site, the designated sites were screened out of further assessment.

Table 1.1: Designated Sites with Ornithological Interest within a 20km Search Radius

Site Name	Designation	Proximity to Site	Qualifying Features
Renfrewshire Heights	SPA, SSSI	10km	Breeding bird assemblage: Hen Harrier
Central Lochs, Bute	SSSI	11km	Non-breeding: Greylag goose
Castle Semple and Barr Lochs	SSSI	15km	Breeding bird assemblage: Great crested Grebe, Tufted Duck, Water Rail, Sedge Warbler, Reed Bunting
Inner Clyde	SPA, Ramsar, SSSI	19km	Non-breeding: Redshank

2 METHODOLOGY

2.1 Intertidal and Nearshore Coastal Surveys

The programme of monthly intertidal and nearshore coastal bird surveys was conducted between April 2021 and July 2021. Surveys were scheduled to cover different tidal conditions (high, low and mid-tide; spring and neap tides) throughout the survey programme.

The intertidal and nearshore coastal bird Survey Area comprised three separate survey sectors, each of which extended out to 1.5km from the shore. To identify the distribution of birds, the count sectors were segregated into three distance bands: 0 - 500m, 500m - 1km and 1km - 1.5km. Figure 2 shows the extent of the Survey Area and its constituent count sectors.

Survey sector A covered the area adjacent to Boathouse Avenue (NS 19749 60729) to Aubery Crescent (NS 20002 60291). Survey sector B covered the area from Aubery Crescent (NS 20002 60291) to the RNLI Lifeboat Station (NS 20139 60055). Survey sector C covered the area from the RNLI Lifeboat Station (NS 20139 60055) to an area north of the pier and ferry terminal (NS 20190 59572).

Survey methods were based on the high tide (core count) methodology of the BTO/JNCC/RSPB/WWT WeBS scheme. This involved the surveyor counting birds from vantage points along the coast using binoculars and a telescope. The birds present during each survey along the foreshore and nearshore coastal waters were counted and ascribed to one of the three distance bands as described above. Observations of bird species (including the numbers of each species in a given location and behaviour) were plotted onto a field map using standard BTO species codes.

Field records were transferred to a Geographic Information System (GIS), from which maps were produced showing the species present, their behaviour and distribution.

Weather conditions including wind speed (using the Beaufort Scale), cloud cover (estimated as eighths or octas of the sky), visibility and temperature were also recorded as well as sources of disturbance to birds encountered during surveys.

The timings of the intertidal and nearshore coastal bird survey effort are given in Table 2.1.

Table 2.1: Intertidal and Nearshore Coastal Bird Survey Effort

Survey Date	Surveyor	Survey start time (hr:mm)	Survey end time (hr:mm)
23/04/2021	GDu	11:15	13:50
17/05/2021	GDu	11:00	14:00
14/06/2021	GDu	09:00	11:20
13/07/2021	PC	13:20	16:40

3 RESULTS

3.1 Intertidal and Nearshore Ornithology Data

A total of 22 species were recorded within the intertidal and nearshore Survey Area during the survey programme. The following survey results for each species should be read in conjunction with Table 3.1 to Table 3.4, along with Figures 3.1 to 3.28.

3.1.1 Waterfowl

The peak monthly count and overall peak counts for waterfowl are shown in Table 3.1.

Mallard were regularly recorded, primarily within Survey Area A. Birds were recorded every month of the survey programme with numbers typically ranging between one and eight individuals. A peak count of 25 birds was recorded in July 2021.

Eider were also regularly recorded, with counts up to nine individuals.

Single observations of shelduck and red-breasted merganser, and two observations of goosander and Canada goose were recorded within the Survey Area. Greylag goose and mute swan were also recorded infrequently. Consequently, the data suggest that the Survey Area is of limited local importance for waterfowl species.

Table 3.1: Total Monthly Counts and Peak Total Monthly Counts of Waterfowl Recorded within each Survey Sector between April and July 2021

Species	Sector	Abundance				
		April	May	June	July	Peak
Canada goose	A	8	-	-	-	8
	B	-	-	-	-	-
	C	-	2	-	-	2
Eider	A	-	2	-	5	5
	B	-	7	7	-	7
	C	2	6	9	-	9
Goosander	A	-	-	-	-	-
	B	-	-	-	-	-
	C	-	2	-	-	2
Greylag goose	A	-	-	-	-	-
	B	-	-	-	-	-
	C	-	1	8	-	8
Mallard	A	-	1	1	25	25
	B	3	3	-	-	3
	C	-	1	-	-	1
Mute swan	A	-	-	-	-	-
	B	3	-	-	-	3
	C	1	-	-	-	1
Red-breasted merganser	A	-	-	-	-	-
	B	-	1	-	-	1
	C	-	-	-	-	-
Shelduck	A	-	-	-	-	-
	B	-	-	-	-	-
	C	-	1	-	-	1

3.1.2 Wading Birds

The peak monthly count and overall peak counts for wading birds are shown in Table 3.2.

Oystercatcher was the most abundant and regularly present species throughout the Survey Area with birds recorded on every month of the survey programme and in all three survey sectors. Numbers typically ranged between approximately two and six individuals. The peak count was 20 individuals (July 2021 – Sector A).

Small numbers of (between one and six) individuals of each common sandpiper, dunlin, ringed plover, turnstone, grey heron and whimbrel were also recorded throughout the Survey Area.

The results show the Survey Area is of limited local importance for waders.

Table 3.2: Total Monthly Counts and Peak Total Monthly Counts of Wading Birds Recorded within each Survey Sector between April and July 2021

Species	Sector	Abundance				
		April	May	June	July	Peak
Common sandpiper	A	2	-	-	-	2
	B	-	-	-	-	-
	C	-	-	-	-	-
Dunlin	A	1	-	-	-	1
	B	-	-	-	-	-
	C	-	-	-	-	-
Grey heron	A	-	-	-	1	1
	B	-	-	-	-	-
	C	-	-	-	-	-
Oystercatcher	A	4	-	5	20	20
	B	-	3	2	-	3
	C	-	5	6	-	6
Ringed plover	A	3	1	2	-	3
	B	-	-	-	-	-
	C	-	-	-	-	-
Turnstone	A	5	-	-	-	5
	B	-	-	-	-	-
	C	-	-	-	-	-
Whimbrel	A	-	-	-	-	-
	B	-	-	-	-	-
	C	-	-	1	-	1

3.1.3 Gulls and Terns

The peak monthly count and overall peak counts for waterfowl are shown in Table 3.3.

Herring gulls were the most abundant and regularly present gull species recorded throughout the Survey Area, being present on every survey in all three survey sectors. Numbers were consistently higher in Sectors B and C with peaks of 27 in Sector A (July 2021), 44 in Sector B (May 2021) and 51 in Sector C (July 2021). Birds were recorded in all three distance bands from the shore, with the data suggesting the Survey Area is of local importance for this species.

Small numbers of black-headed gull, great and lesser black-backed gulls and common gulls were recorded throughout the Survey Area, with peak counts of between two and 12 individuals of each species. Sandwich tern were rarely recorded within the Survey Area, with four individuals recorded in Sector A in April 2021. Consequently, the data suggest the Survey Area is of limited local importance for these other gull and tern species.

Table 3.3: Total Monthly Counts and Peak Total Monthly Counts of Gulls and Terns Recorded within each Survey Sector between April and July 2021

Species	Sector	Abundance				
		April	May	June	July	Peak
Black-headed gull	A	-	-	-	2	2
	B	4	1	5	-	5
	C	4	1	-	-	4
Common gull	A	9	3	-	1	9
	B	-	3	-	-	3
	C	-	3	-	-	3
Great black-backed gull	A	-	-	5	9	9
	B	-	1	4	1	4
	C	2	-	12	9	12
Herring gull	A	-	-	12	27	27
	B	18	44	6	27	44
	C	8	8	42	51	51
Lesser black-backed gull	A	2	4	2	7	7
	B	-	5	-	1	5
	C	-	3	2	-	3
Sandwich tern	A	4	-	-	-	4
	B	-	-	-	-	-
	C	-	-	-	-	-

3.1.4 Other Seabirds

Cormorants and shags were present in the Survey Area, although numbers were generally low. Typically, there were no more than 10 individuals recorded. The majority of birds recorded were within the 0-500m distance band.

Low numbers of guillemot, black guillemot, gannet and Manx shearwater were recorded across the Survey Area.

The peak monthly count and overall peak counts for waterfowl are shown in Table 3.4.

Table 3.4: Total Monthly Counts and Peak Total Peak Counts of other Seabirds Recorded within each Survey Sector between April and July 2021

Species	Sector	Abundance				
		April	May	June	July	Peak
Black guillemot	A	4	-	-	1	4
	B	-	1	-	1	1
	C	2	-	-	-	2
Cormorant	A	3	3	-	1	3
	B	-	-	1	1	1
	C	-	1	1	1	1
Gannet	A	6	-	4	1	6
	B	1	-	3	2	3
	C	3	1	8	-	8
Guillemot	A	1	-	-	-	1
	B	1	-	-	-	1
	C	-	1	-	-	1

Species	Sector	Abundance				
		April	May	June	July	Peak
Manx shearwater	A	-	-	3	3	3
	B	-	-	12	-	12
	C	-	-	13	-	13
Shag	A	7	1	3	10	10
	B	4	6	3	2	6
	C	4	1	5	-	5

4 SUMMARY AND CONCLUSIONS

The intertidal and nearshore ornithology surveys revealed relatively low numbers of birds present on the open water in front of the proposed works, with species present being relatively common birds.

The only location where birds were consistently clustered was the mouth of the Gogo Brun, on the inter-tidal habitat there. Although this location is relatively close to the proposed works, and some birds may be disturbed, given the current background levels of traffic and other activity along the seafront, disturbance is not considered likely to be significant in the long term.

Gulls were the most numerous species group, with herring gull present in largest numbers. The Survey Area is therefore considered of local importance for this species only. For all other species recorded, the Survey Area is of limited local importance.

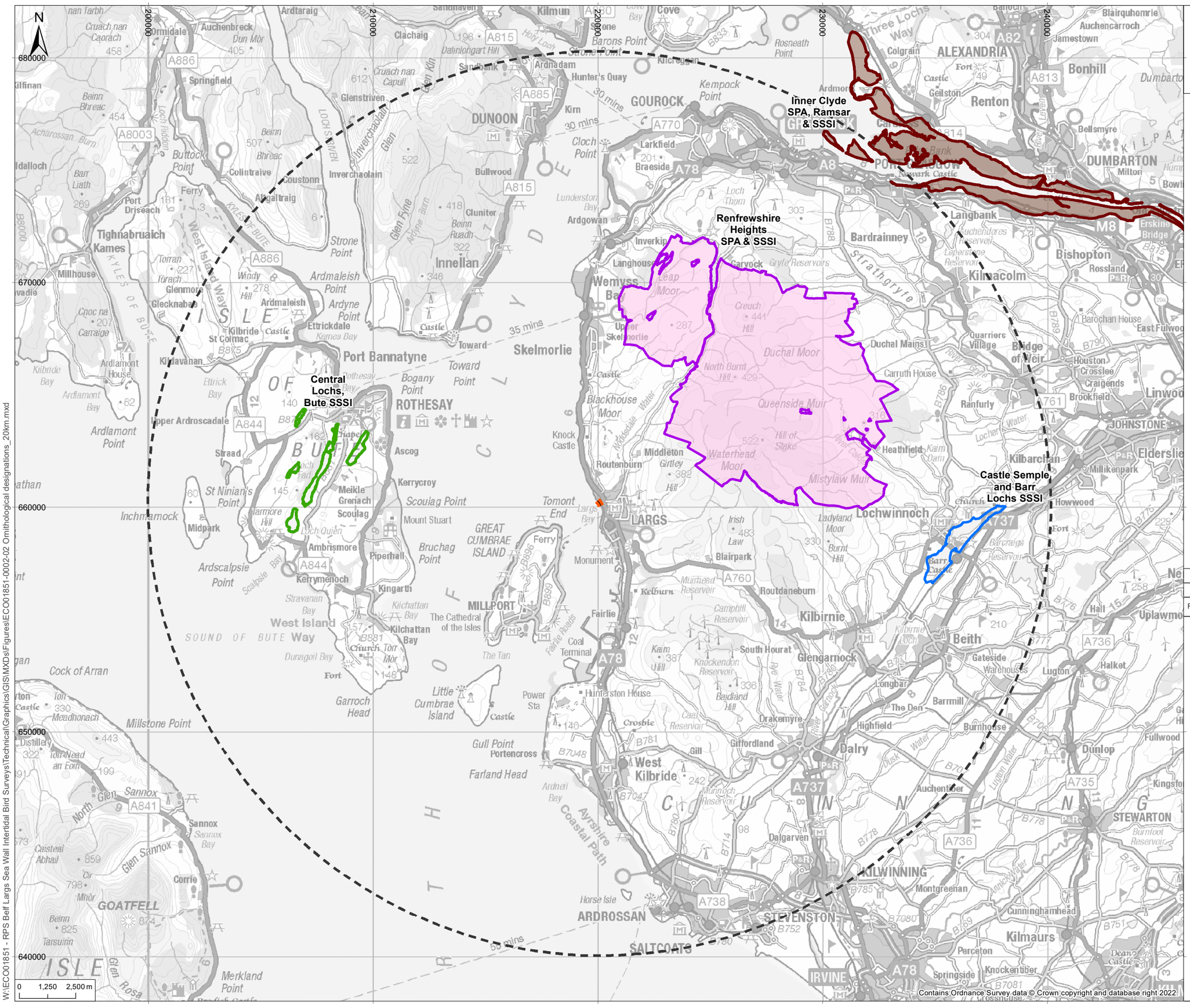
Black guillemot were recorded during the surveys confirming their presence in the area. As this species is known to nest within sea wall structures it is recommended the pre-construction surveys should be carried out before the construction takes place to avoid infringement of the Wildlife and Countryside Act 1981 (as amended). If any breeding birds are found then following advice of the Ecological Clerk of Works would be required on site. However, given the nature of the current shoreline, the likelihood of nesting black guillemot is considered relatively low.

FIGURES

Figure 1: Ornithological Designated Sites within 20km

Figure 2: Survey Area and Count Sectors

Figure 3: Intertidal Breeding Bird Surveys: Black Guillemot

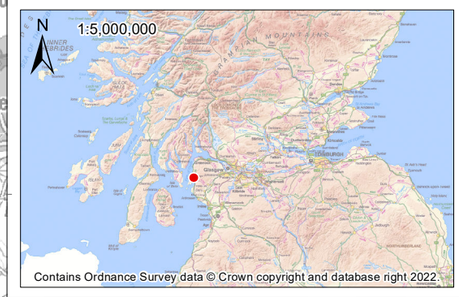


© 2022 RPS Group

Notes
1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.

Legend

- Sea Wall - Improvement Area
- 20km search area
- Renfrewshire Heights SPA
- Inner Clyde SPA and Ramsar Site
- Castle Semple and Barr Lochs SSSI
- Central Lochs, Bute SSSI
- Inner Clyde SSSI
- Renfrewshire Heights SSSI



Rev	Description	By	CB	Date

MAKING COMPLEX EASY

Atholl Exchange, 1st Floor, 6 Canning Street, Edinburgh EH3 8EG
T: +44(0)131 555 5011 E: rpsed2@rpsgroup.com

Client	North Ayrshire Council
Project	Largs Sea Wall Improvements
Title	Ornithological Designated Sites within 20km

Status	Drawn By	PM/Checked By
FINAL	KAG	SZ
Project Number	**Scale @ A3**	**Date Created**
ECO1851	1:160,000	JAN 2022
Figure Number		**Rev**
1		-

rpsgroup.com

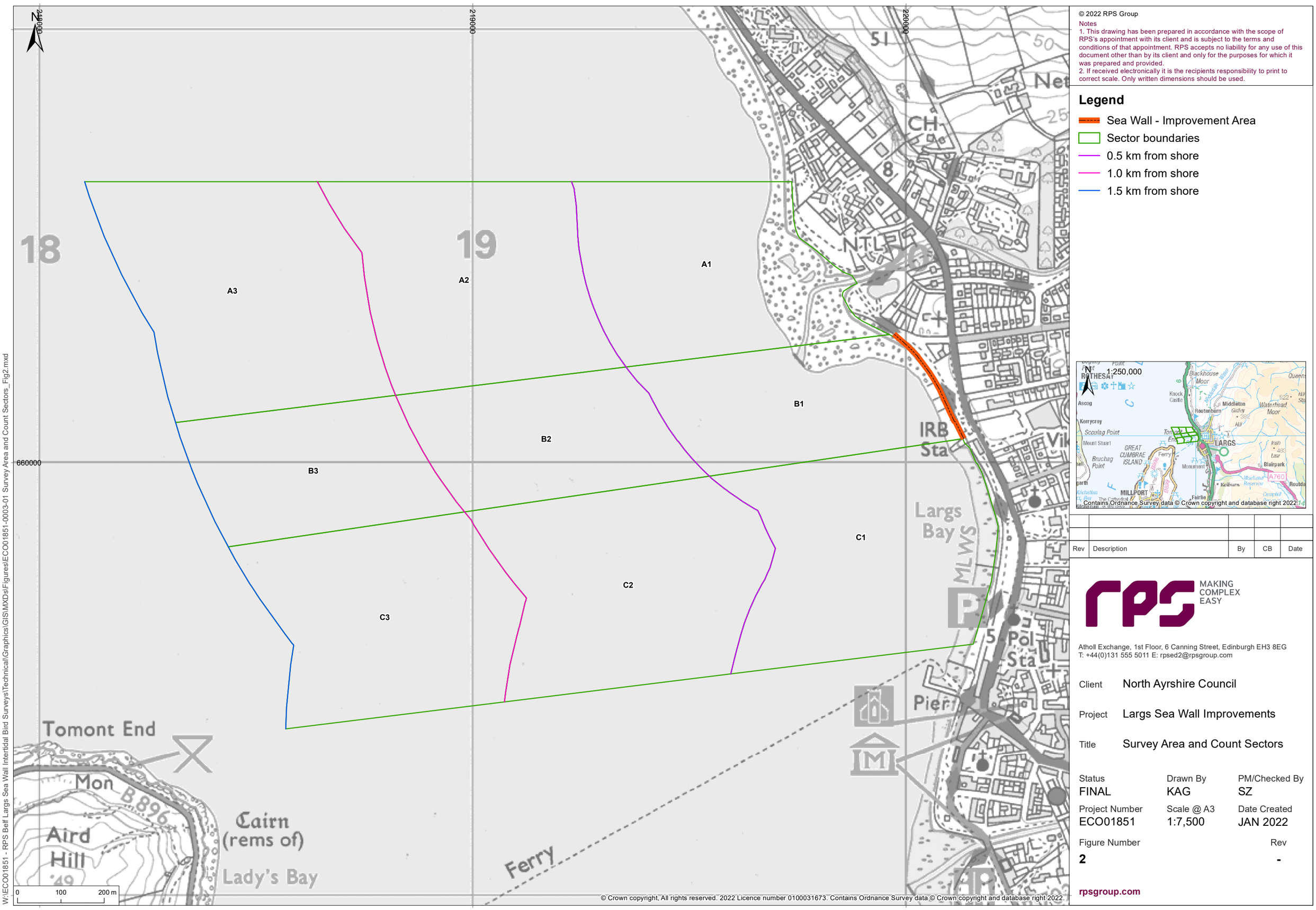
W:\ECO01851 - RPS Bell\Largs Sea Wall Intertidal Bird Surveys\Technical\Graphics\GIS\MXDs\Figures\ECO01851-0002-02 Ornithological designations_20km.mxd

© 2022 RPS Group

Notes
1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.

Legend

- Sea Wall - Improvement Area
- Sector boundaries
- 0.5 km from shore
- 1.0 km from shore
- 1.5 km from shore



Rev	Description	By	CB	Date

MAKING COMPLEX EASY

Atholl Exchange, 1st Floor, 6 Canning Street, Edinburgh EH3 8EG
T: +44(0)131 555 5011 E: rpsed2@rpsgroup.com

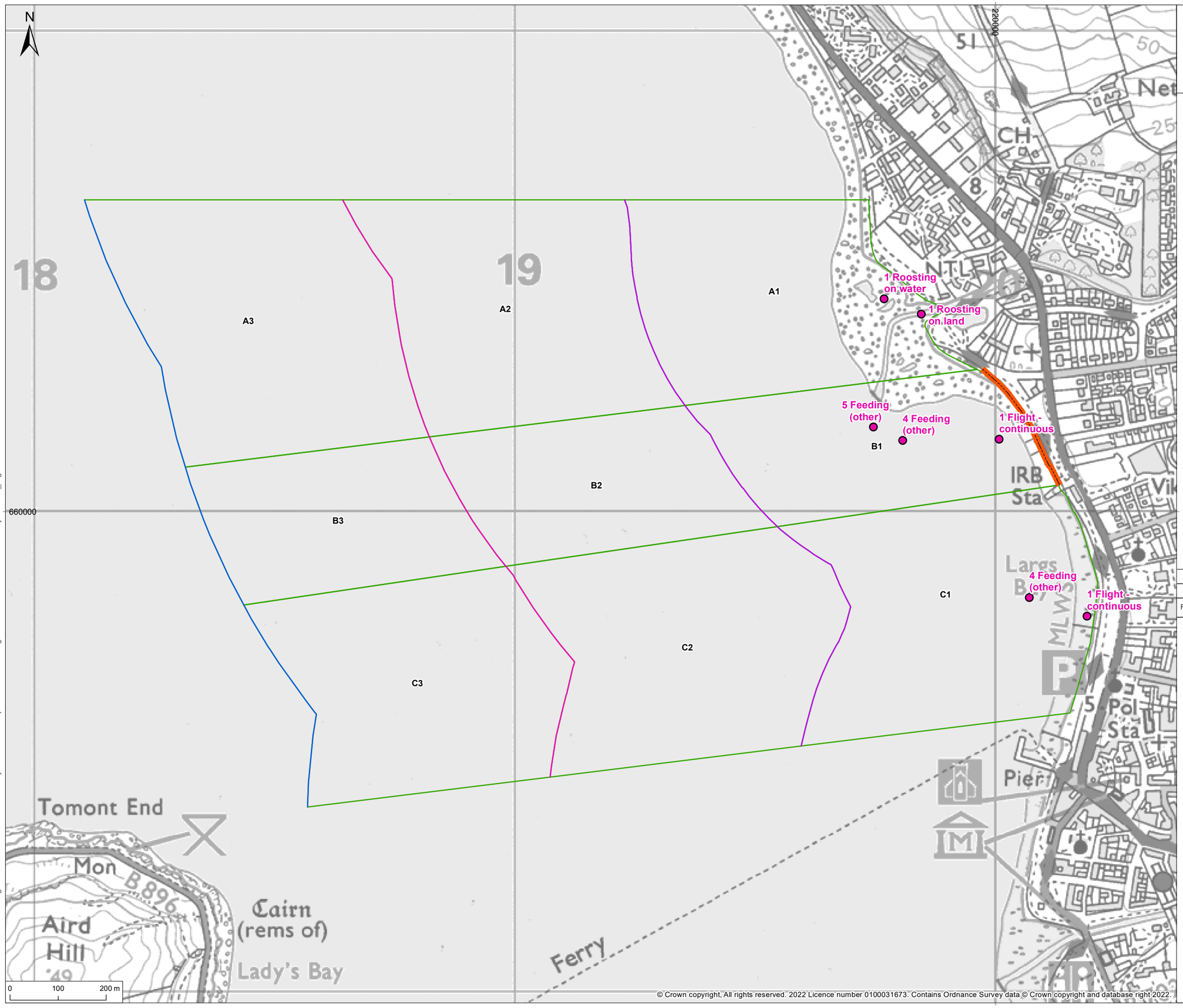
Client	North Ayrshire Council
Project	Largs Sea Wall Improvements
Title	Survey Area and Count Sectors

Status	Drawn By	PM/Checked By
FINAL	KAG	SZ
Project Number	**Scale @ A3**	**Date Created**
ECO01851	1:7,500	JAN 2022
Figure Number		**Rev**
2		**-**

rpsgroup.com

© Crown copyright, All rights reserved. 2022 Licence number 0100031673. Contains Ordnance Survey data © Crown copyright and database right 2022.

W:\ECO01851 - RPS Belf Largs Sea Wall Intertidal Bird Surveys\Technical\Graphics\GIS\MXDs\Figures\ECO01851-0003-01 Survey Area and Count Sectors_Fig2.mxd

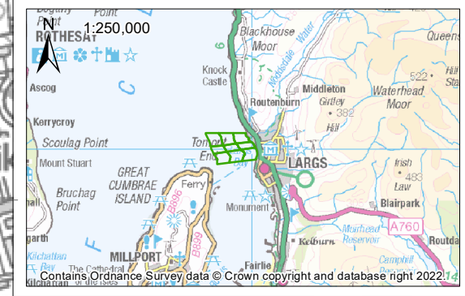


© 2022 RPS Group

Notes
1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.

Legend

- Sea Wall - Improvement Area
- Sector boundaries
- 0.5 km from shore
- 1.0 km from shore
- 1.5 km from shore
- Tidal bird count



Rev	Description	By	CB	Date

MAKING COMPLEX EASY

Atholl Exchange, 1st Floor, 6 Canning Street, Edinburgh EH3 8EG
T: +44(0)131 555 5011 E: rpsed2@rpsgroup.com

Client: North Ayrshire Council

Project: Largs Sea Wall Improvements

Title: Intertidal Breeding Bird Surveys: Black-headed Gull

Status	Drawn By	PM/Checked By
FINAL	KAG	SZ

Project Number	Scale @ A3	Date Created
ECO01851	1:7,500	JAN 2022

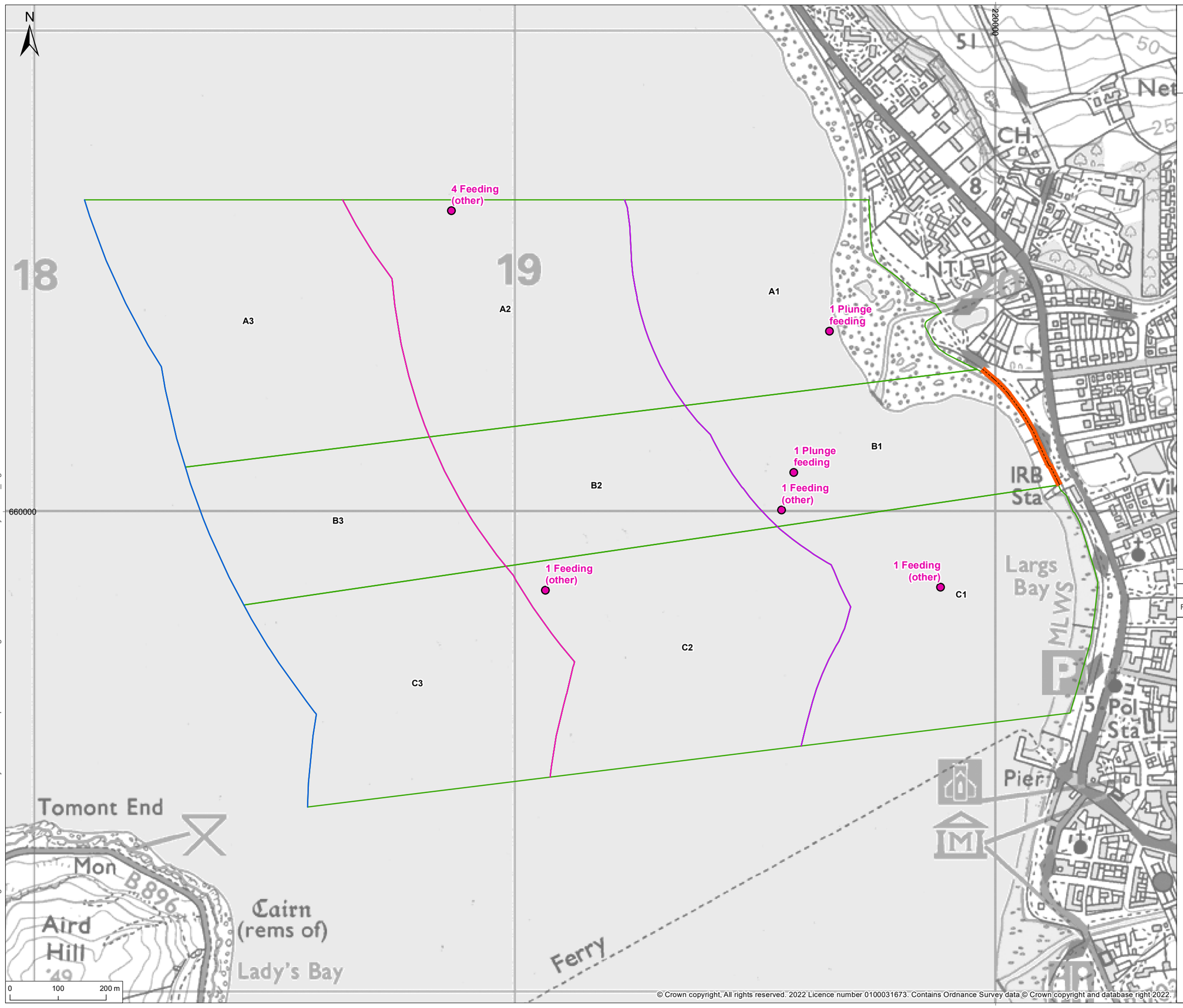
Figure Number: **3.1**

Rev: -

rpsgroup.com

© Crown copyright, All rights reserved. 2022 Licence number 0100031673. Contains Ordnance Survey data © Crown copyright and database right 2022.

W:\ECO01851 - RPS Belf Largs Sea Wall Intertidal Bird Surveys\Technical\Graphics\GIS\MXDs\Figures\ECO01851-0001-02 Survey Results_Fig3.mxd

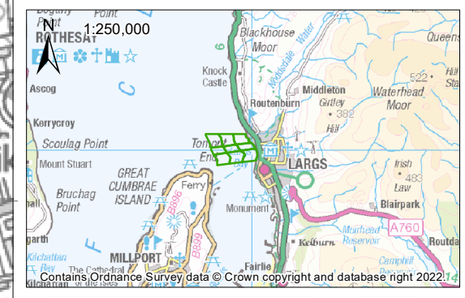


© 2022 RPS Group

Notes
1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.

Legend

- Sea Wall - Improvement Area
- Sector boundaries
- 0.5 km from shore
- 1.0 km from shore
- 1.5 km from shore
- Tidal bird count



Rev	Description	By	CB	Date

MAKING COMPLEX EASY

Atholl Exchange, 1st Floor, 6 Canning Street, Edinburgh EH3 8EG
T: +44(0)131 555 5011 E: rpsed2@rpsgroup.com

Client	North Ayrshire Council
Project	Largs Sea Wall Improvements
Title	Intertidal Breeding Bird Surveys: Black Guillemot

Status	Drawn By	PM/Checked By
FINAL	KAG	SZ
Project Number	**Scale @ A3**	**Date Created**
ECO01851	1:7,500	JAN 2022
Figure Number		**Rev**
3.2		**-**

rpsgroup.com

© Crown copyright, All rights reserved. 2022 Licence number 0100031673. Contains Ordnance Survey data © Crown copyright and database right 2022.

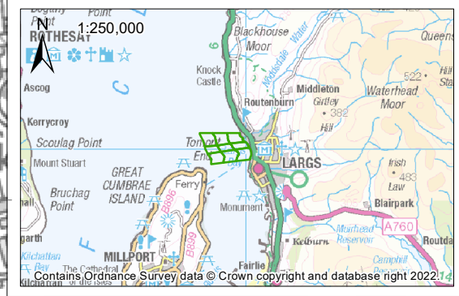
W:\ECO01851 - RPS Belf Largs Sea Wall Intertidal Bird Surveys\Technical\Graphics\GIS\MXDs\Figures\ECO01851-0001-02 Survey Results_Fig3.mxd

© 2022 RPS Group

Notes
1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.

Legend

- Sea Wall - Improvement Area
- Sector boundaries
- 0.5 km from shore
- 1.0 km from shore
- 1.5 km from shore
- Tidal bird count



Rev	Description	By	CB	Date

MAKING COMPLEX EASY

Atholl Exchange, 1st Floor, 6 Canning Street, Edinburgh EH3 8EG
T: +44(0)131 555 5011 E: rpsed2@rpsgroup.com

Client	North Ayrshire Council
Project	Largs Sea Wall Improvements
Title	Intertidal Breeding Bird Surveys: Canada Goose

Status	Drawn By	PM/Checked By
FINAL	KAG	SZ
Project Number	**Scale @ A3**	**Date Created**
ECO01851	1:7,500	JAN 2022
Figure Number		**Rev**
3.3		-

rpsgroup.com

N

18 19

A1 A2 A3 B1 B2 B3 C1 C2 C3

6 Flight - continuous

2 Feeding (other)

2 Flight - continuous

220000

660000

Tomont End

Mon

B896

Aird Hill

Cairn (rems of)

Lady's Bay

Ferry

IRB Sta

Largs Bay

MLWS

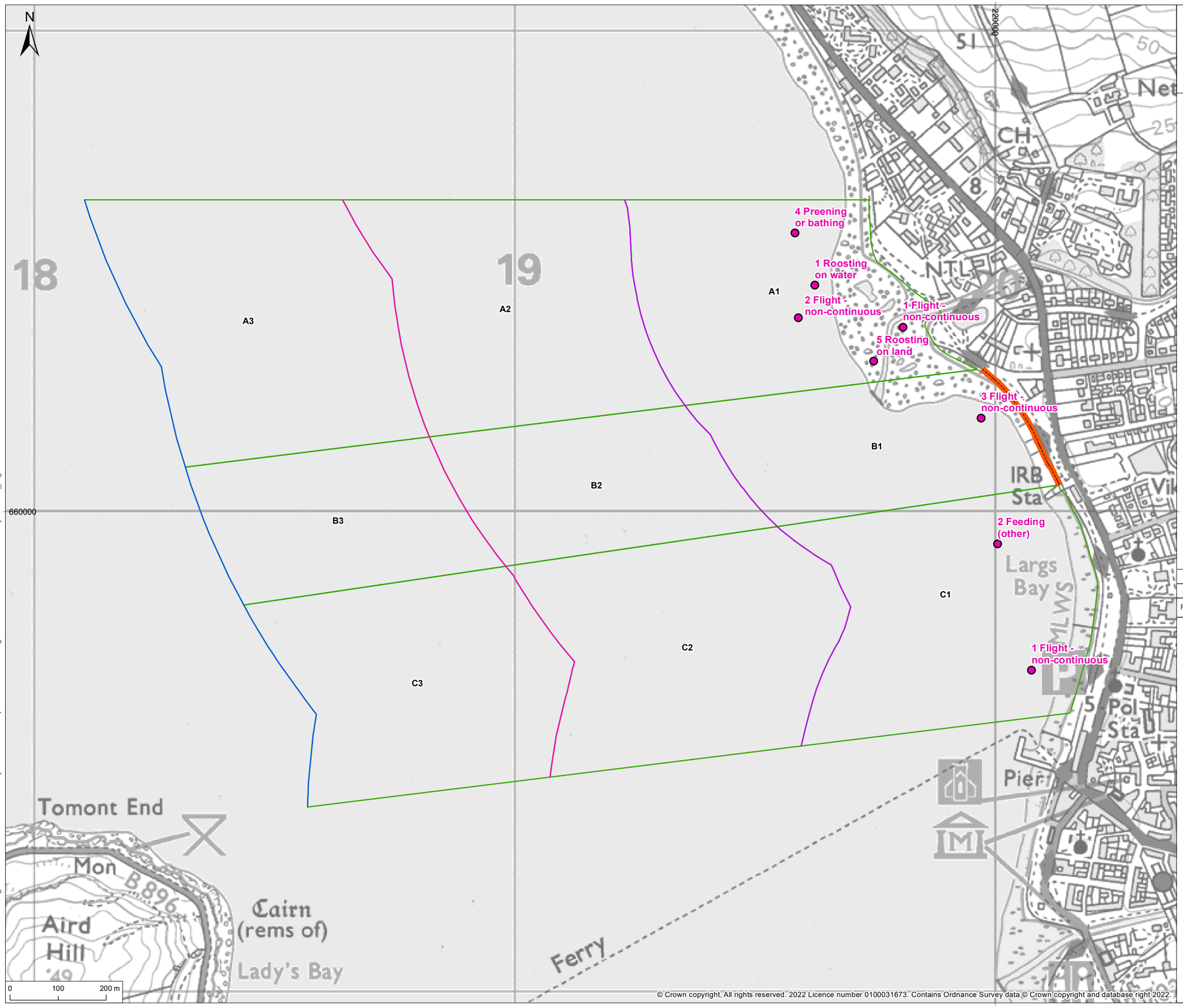
Pier

Pol Sta

0 100 200 m

© Crown copyright, All rights reserved. 2022 Licence number 0100031673. Contains Ordnance Survey data © Crown copyright and database right 2022.

W:\ECO01851 - RPS Belf Largs Sea Wall Intertidal Bird Surveys\Technical\Graphics\GIS\MXDs\Figures\ECO01851-0001-02 Survey Results_Fig3.mxd

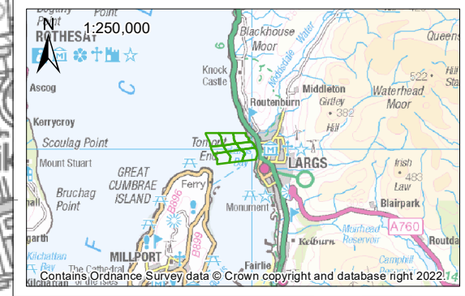


© 2022 RPS Group

Notes
1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.

Legend

- Sea Wall - Improvement Area
- Sector boundaries
- 0.5 km from shore
- 1.0 km from shore
- 1.5 km from shore
- Tidal bird count



Rev	Description	By	CB	Date

MAKING COMPLEX EASY

Atholl Exchange, 1st Floor, 6 Canning Street, Edinburgh EH3 8EG
T: +44(0)131 555 5011 E: rpsed2@rpsgroup.com

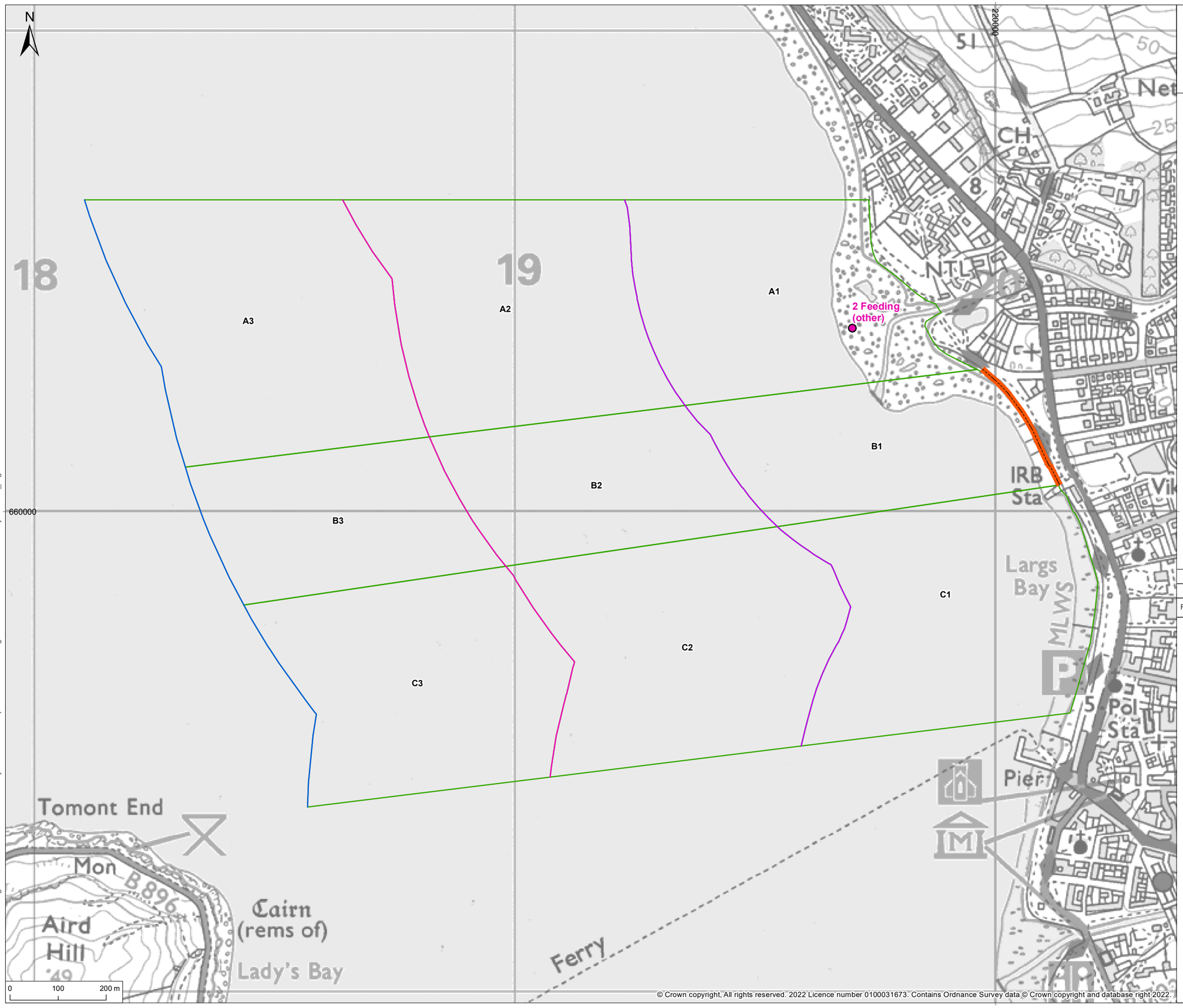
Client	North Ayrshire Council
Project	Largs Sea Wall Improvements
Title	Intertidal Breeding Bird Surveys: Common Gull

Status	Drawn By	PM/Checked By
FINAL	KAG	SZ
Project Number	**Scale @ A3**	**Date Created**
ECO01851	1:7,500	JAN 2022
Figure Number		**Rev**
3.4		-

rpsgroup.com

© Crown copyright, All rights reserved. 2022 Licence number 0100031673. Contains Ordnance Survey data © Crown copyright and database right 2022.

W:\ECO01851 - RPS Belf Largs Sea Wall Intertidal Bird Surveys\Technical\Graphics\GIS\MXDs\Figures\ECO01851-0001-02 Survey Results_Fig3.mxd

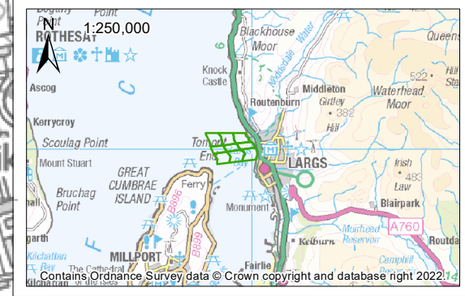


© 2022 RPS Group

Notes
1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.

Legend

- Sea Wall - Improvement Area
- Sector boundaries
- 0.5 km from shore
- 1.0 km from shore
- 1.5 km from shore
- Tidal bird count



Rev	Description	By	CB	Date

MAKING COMPLEX EASY

Atholl Exchange, 1st Floor, 6 Canning Street, Edinburgh EH3 8EG
T: +44(0)131 555 5011 E: rpsed2@rpsgroup.com

Client: North Ayrshire Council

Project: Largs Sea Wall Improvements

Title: Intertidal Breeding Bird Surveys: Common Sandpiper

Status	Drawn By	PM/Checked By
FINAL	KAG	SZ

Project Number	Scale @ A3	Date Created
ECO01851	1:7,500	JAN 2022

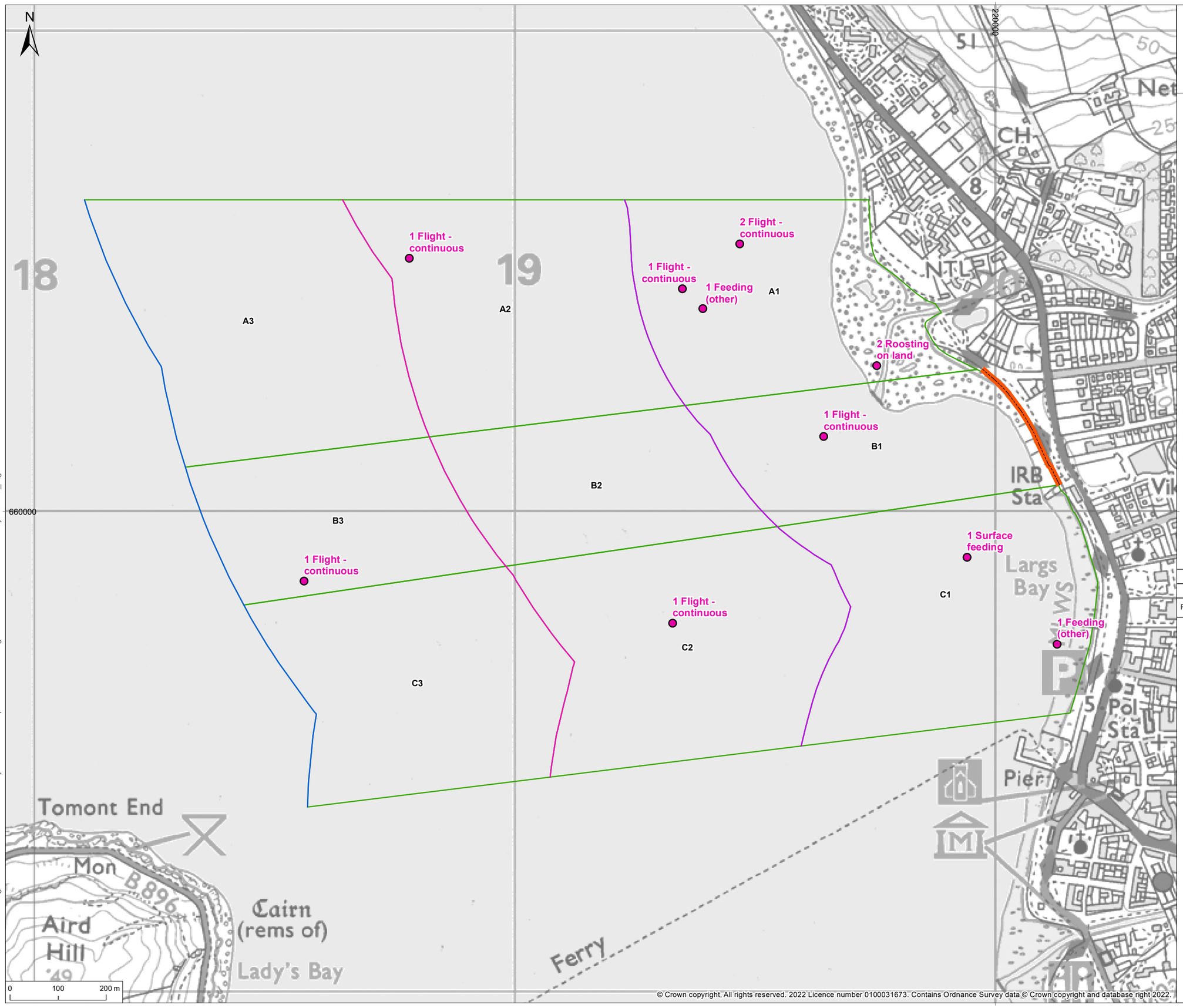
Figure Number: **3.5**

Rev: -

rpsgroup.com

© Crown copyright, All rights reserved. 2022 Licence number 0100031673. Contains Ordnance Survey data © Crown copyright and database right 2022.

W:\ECO01851 - RPS Belf Largs Sea Wall Intertidal Bird Surveys\Technical\Graphics\GIS\MXDs\Figures\ECO01851-0001-02 Survey Results_Fig3.mxd

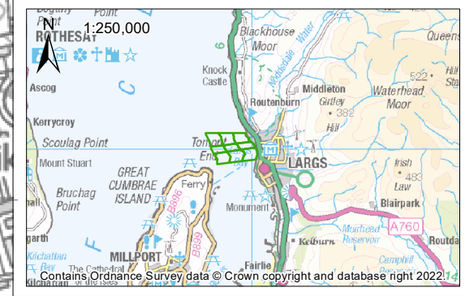


© 2022 RPS Group

Notes
1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.

Legend

- Sea Wall - Improvement Area
- Sector boundaries
- 0.5 km from shore
- 1.0 km from shore
- 1.5 km from shore
- Tidal bird count



Rev	Description	By	CB	Date

Atholl Exchange, 1st Floor, 6 Canning Street, Edinburgh EH3 8EG
T: +44(0)131 555 5011 E: rpsed2@rpsgroup.com

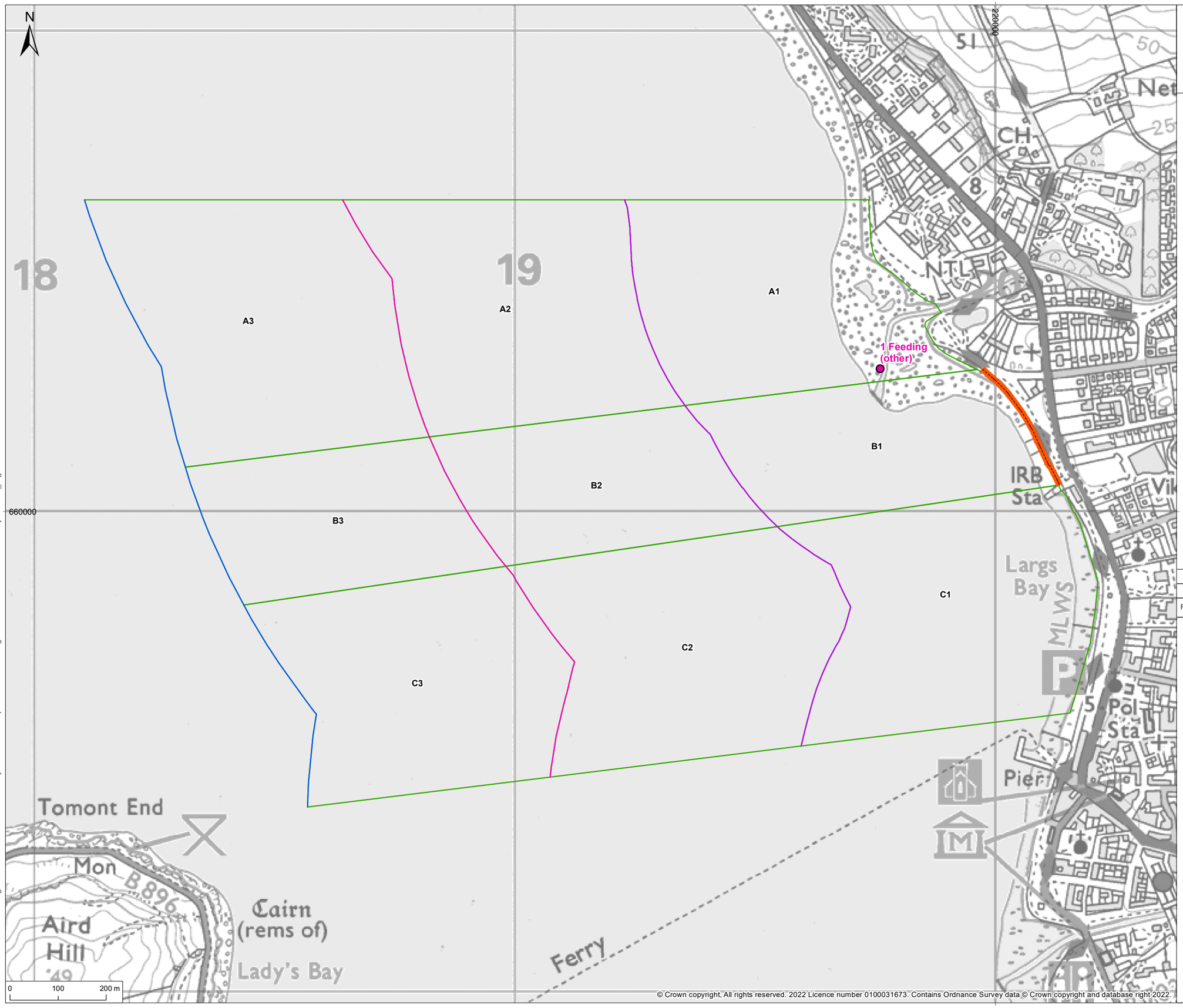
Client	North Ayrshire Council
Project	Largs Sea Wall Improvements
Title	Intertidal Breeding Bird Surveys: Cormorant

Status	Drawn By	PM/Checked By
FINAL	KAG	SZ
Project Number	**Scale @ A3**	**Date Created**
ECO01851	1:7,500	JAN 2022
Figure Number		**Rev**
3.6		-

rpsgroup.com

© Crown copyright, All rights reserved. 2022 Licence number 0100031673. Contains Ordnance Survey data © Crown copyright and database right 2022.

W:\ECO01851 - RPS Belf Largs Sea Wall Intertidal Bird Surveys\Technical\Graphics\GIS\MXDs\Figures\ECO01851-0001-02 Survey Results_Fig3.mxd

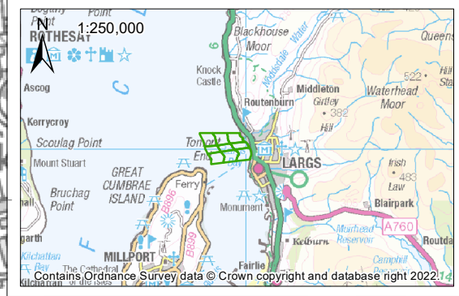


© 2022 RPS Group

Notes
1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.

Legend

- Sea Wall - Improvement Area
- Sector boundaries
- 0.5 km from shore
- 1.0 km from shore
- 1.5 km from shore
- Tidal bird count



Rev	Description	By	CB	Date

Atholl Exchange, 1st Floor, 6 Canning Street, Edinburgh EH3 8EG
T: +44(0)131 555 5011 E: rpsed2@rpsgroup.com

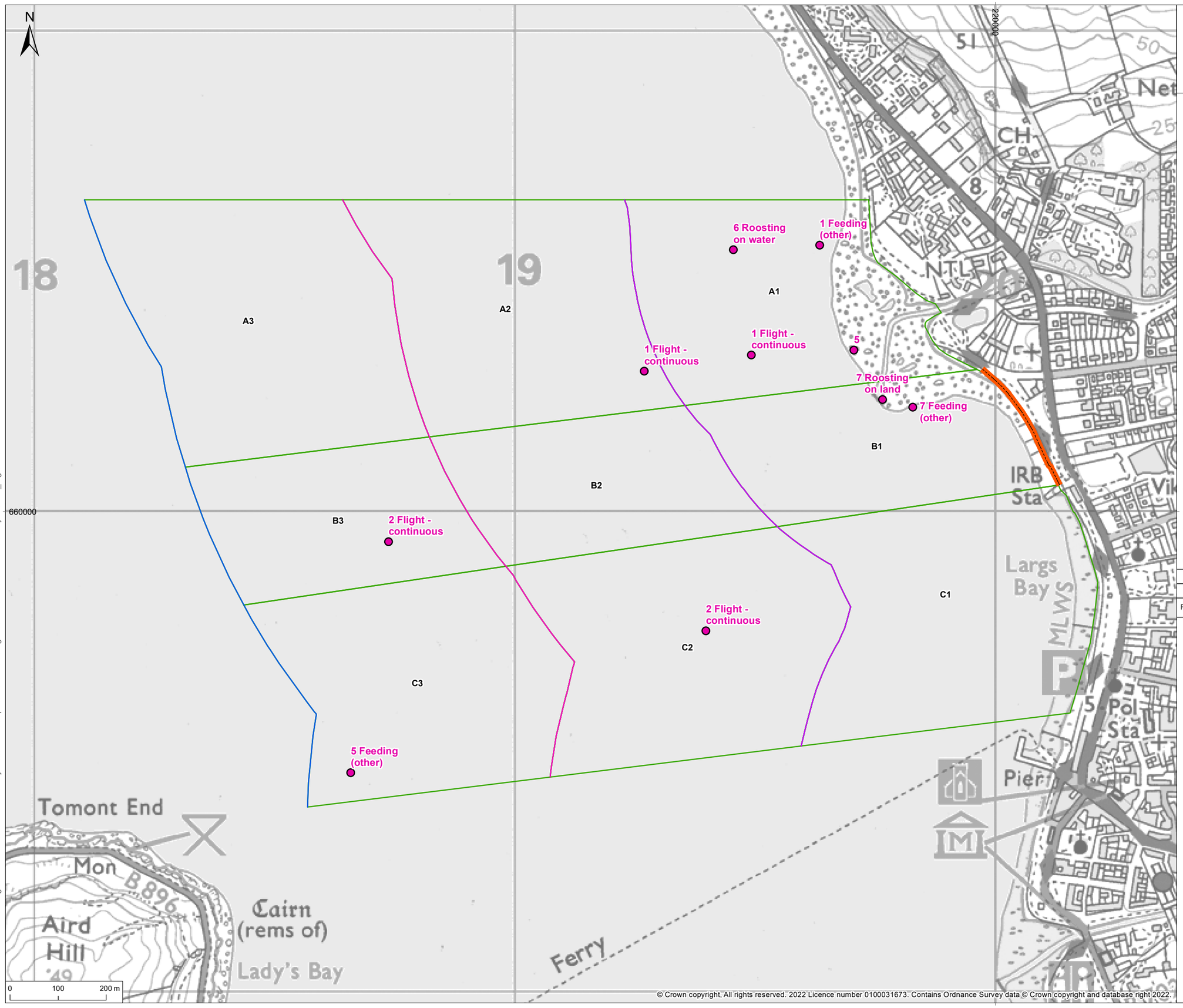
Client	North Ayrshire Council
Project	Largs Sea Wall Improvements
Title	Intertidal Breeding Bird Surveys: Dunlin

Status	Drawn By	PM/Checked By
FINAL	KAG	SZ
Project Number	**Scale @ A3**	**Date Created**
ECO01851	1:7,500	JAN 2022
Figure Number		**Rev**
3.7		**-**

rpsgroup.com

© Crown copyright, All rights reserved. 2022 Licence number 0100031673. Contains Ordnance Survey data © Crown copyright and database right 2022.

W:\ECO01851 - RPS Belf Largs Sea Wall Intertidal Bird Surveys\Technical\Graphics\GIS\MXDs\Figures\ECO01851-0001-02 Survey Results_Fig3.mxd

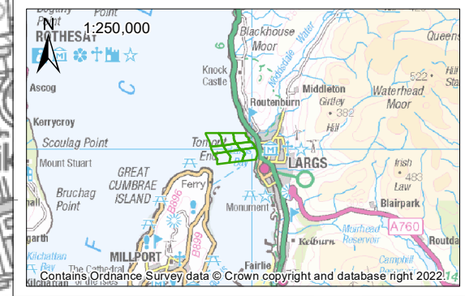


© 2022 RPS Group

Notes
1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.

Legend

- Sea Wall - Improvement Area
- Sector boundaries
- 0.5 km from shore
- 1.0 km from shore
- 1.5 km from shore
- Tidal bird count



Rev	Description	By	CB	Date

MAKING COMPLEX EASY

Atholl Exchange, 1st Floor, 6 Canning Street, Edinburgh EH3 8EG
T: +44(0)131 555 5011 E: rpsed2@rpsgroup.com

Client: North Ayrshire Council

Project: Largs Sea Wall Improvements

Title: Intertidal Breeding Bird Surveys: Eider

Status	Drawn By	PM/Checked By
FINAL	KAG	SZ

Project Number	Scale @ A3	Date Created
ECO01851	1:7,500	JAN 2022

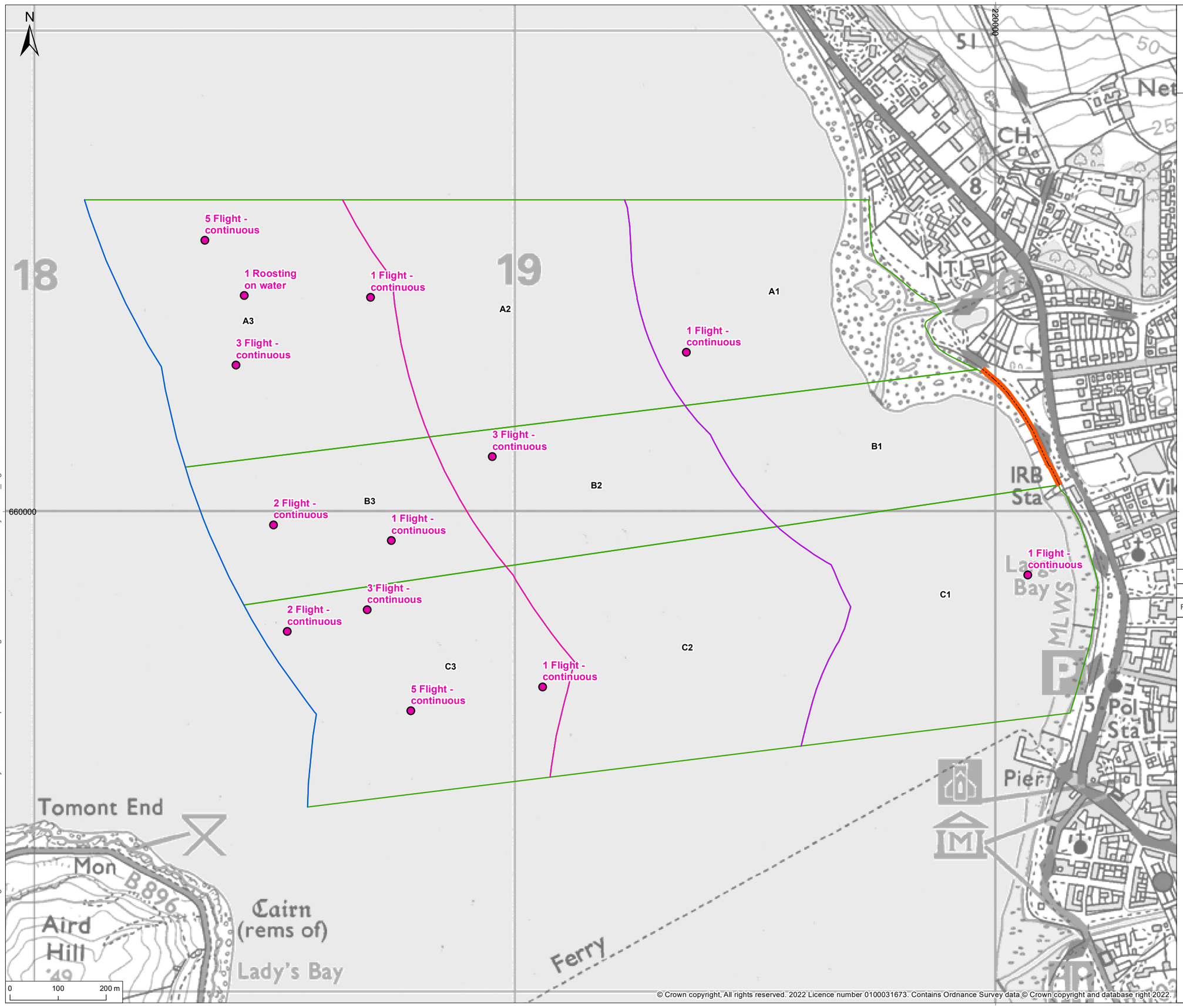
Figure Number: **3.8**

Rev: -

rpsgroup.com

© Crown copyright, All rights reserved. 2022 Licence number 0100031673. Contains Ordnance Survey data © Crown copyright and database right 2022.

W:\ECO01851 - RPS Belf Largs Sea Wall Intertidal Bird Surveys\Technical\Graphics\GIS\MXDs\Figures\ECO01851-0001-02 Survey Results_Fig3.mxd

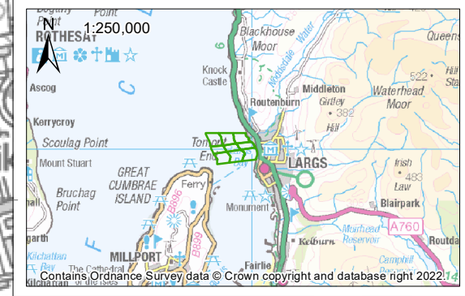


© 2022 RPS Group

Notes
1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.

Legend

- Sea Wall - Improvement Area
- Sector boundaries
- 0.5 km from shore
- 1.0 km from shore
- 1.5 km from shore
- Tidal bird count



Rev	Description	By	CB	Date

Atholl Exchange, 1st Floor, 6 Canning Street, Edinburgh EH3 8EG
T: +44(0)131 555 5011 E: rpsed2@rpsgroup.com

Client: North Ayrshire Council

Project: Largs Sea Wall Improvements

Title: Intertidal Breeding Bird Surveys: Gannet

Status	Drawn By	PM/Checked By
FINAL	KAG	SZ

Project Number	Scale @ A3	Date Created
ECO01851	1:7,500	JAN 2022

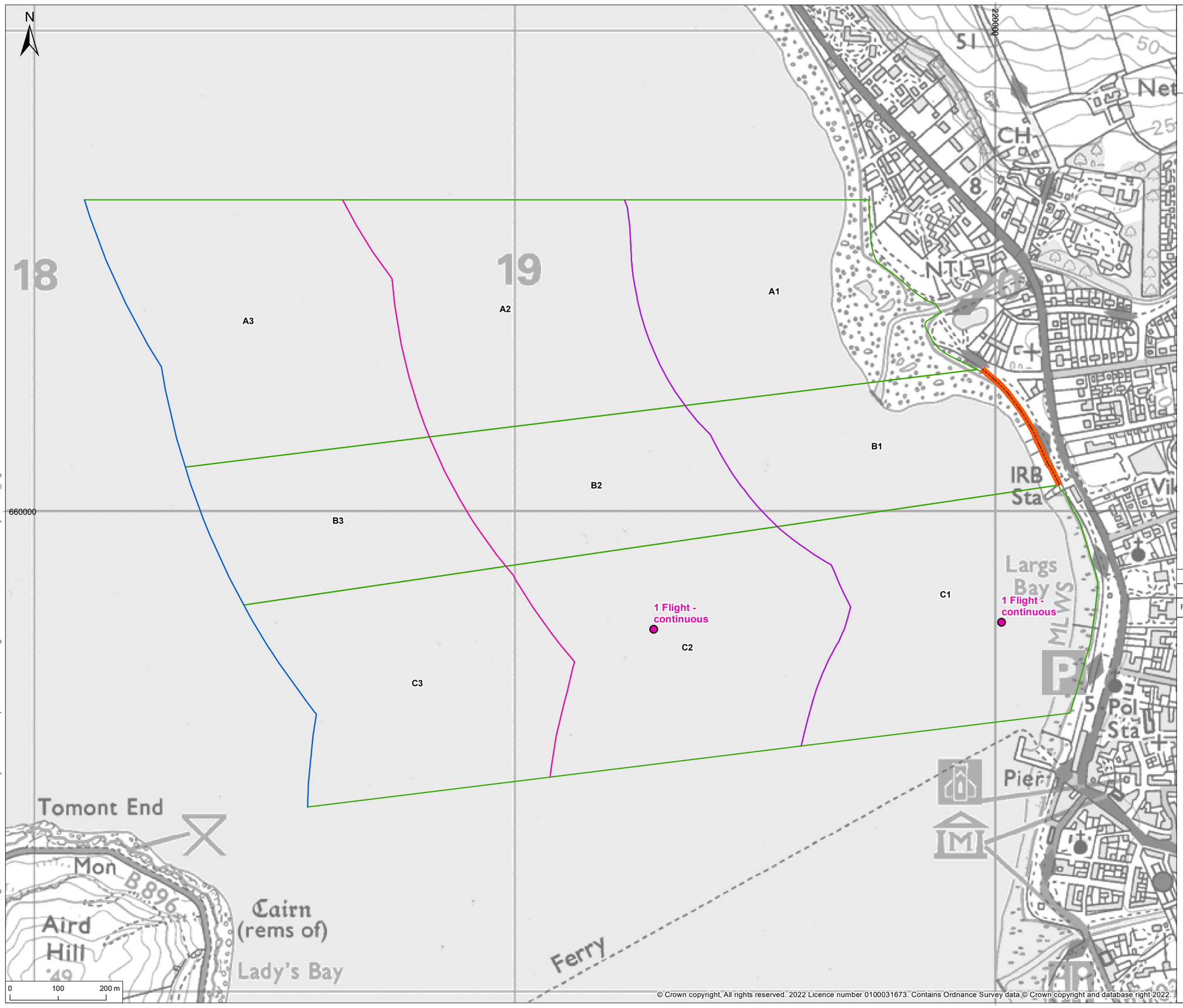
Figure Number: **3.9**

Rev: -

rpsgroup.com

© Crown copyright, All rights reserved. 2022 Licence number 0100031673. Contains Ordnance Survey data © Crown copyright and database right 2022.

W:\ECO01851 - RPS Belf Largs Sea Wall Intertidal Bird Surveys\Technical\Graphics\GIS\MXDs\Figures\ECO01851-0001-02 Survey Results_Fig3.mxd

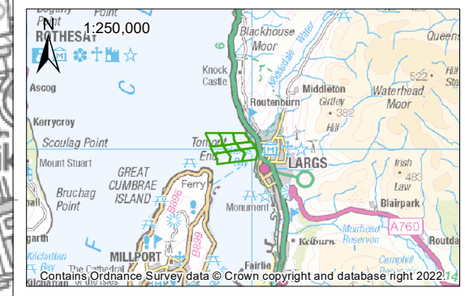


© 2022 RPS Group

Notes
1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.

Legend

- Sea Wall - Improvement Area
- Sector boundaries
- 0.5 km from shore
- 1.0 km from shore
- 1.5 km from shore
- Tidal bird count



Rev	Description	By	CB	Date

Atholl Exchange, 1st Floor, 6 Canning Street, Edinburgh EH3 8EG
T: +44(0)131 555 5011 E: rpsed2@rpsgroup.com

Client	North Ayrshire Council
Project	Largs Sea Wall Improvements
Title	Intertidal Breeding Bird Surveys: Goosander

Status	Drawn By	PM/Checked By
FINAL	KAG	SZ
Project Number	**Scale @ A3**	**Date Created**
ECO01851	1:7,500	JAN 2022
Figure Number		**Rev**
3.10		-

rpsgroup.com

© Crown copyright, All rights reserved. 2022 Licence number 0100031673. Contains Ordnance Survey data © Crown copyright and database right 2022.

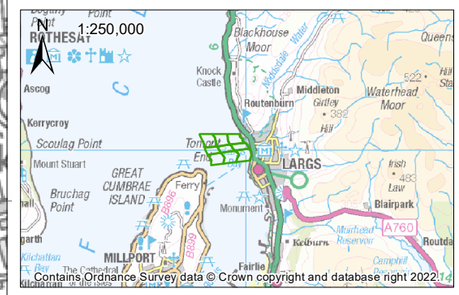
W:\ECO01851 - RPS Belf Largs Sea Wall Intertidal Bird Surveys\Technical\Graphics\GIS\MXDs\Figures\ECO01851-0001-02 Survey Results_Fig3.mxd

© 2022 RPS Group

Notes
1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.

Legend

- Sea Wall - Improvement Area
- Sector boundaries
- 0.5 km from shore
- 1.0 km from shore
- 1.5 km from shore
- Tidal bird count



Rev	Description	By	CB	Date

MAKING COMPLEX EASY

Atholl Exchange, 1st Floor, 6 Canning Street, Edinburgh EH3 8EG
T: +44(0)131 555 5011 E: rpsed2@rpsgroup.com

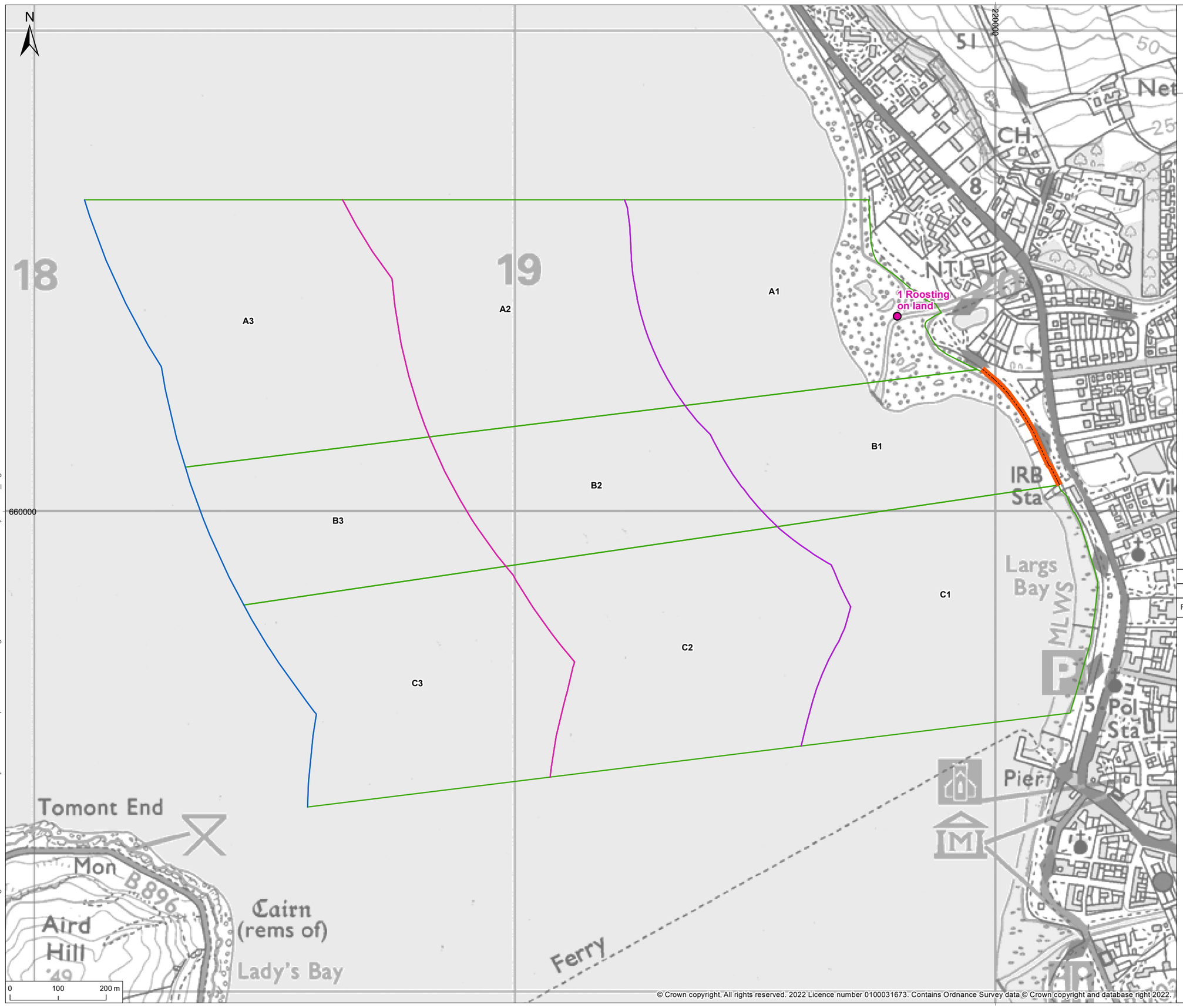
Client	North Ayrshire Council
Project	Largs Sea Wall Improvements
Title	Intertidal Breeding Bird Surveys: Great Black-backed Gull

Status	Drawn By	PM/Checked By
FINAL	KAG	SZ
Project Number	**Scale @ A3**	**Date Created**
ECO01851	1:7,500	JAN 2022
Figure Number		**Rev**
3.11		-

rpsgroup.com

© Crown copyright, All rights reserved. 2022 Licence number 0100031673. Contains Ordnance Survey data © Crown copyright and database right 2022.

W:\ECO01851 - RPS Bell Largs Sea Wall Intertidal Bird Surveys\Technical\Graphics\GIS\MXDs\Figures\ECO01851-0001-02 Survey Results_Fig3.mxd

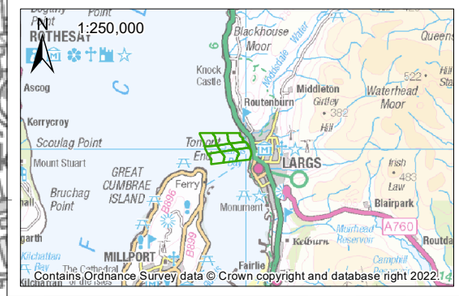


© 2022 RPS Group

Notes
1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.

Legend

- Sea Wall - Improvement Area
- Sector boundaries
- 0.5 km from shore
- 1.0 km from shore
- 1.5 km from shore
- Tidal bird count



Rev	Description	By	CB	Date

rps MAKING COMPLEX EASY

Atholl Exchange, 1st Floor, 6 Canning Street, Edinburgh EH3 8EG
T: +44(0)131 555 5011 E: rpsed2@rpsgroup.com

Client: North Ayrshire Council

Project: Largs Sea Wall Improvements

Title: Intertidal Breeding Bird Surveys: Grey Heron

Status	Drawn By	PM/Checked By
FINAL	KAG	SZ

Project Number	Scale @ A3	Date Created
ECO01851	1:7,500	JAN 2022

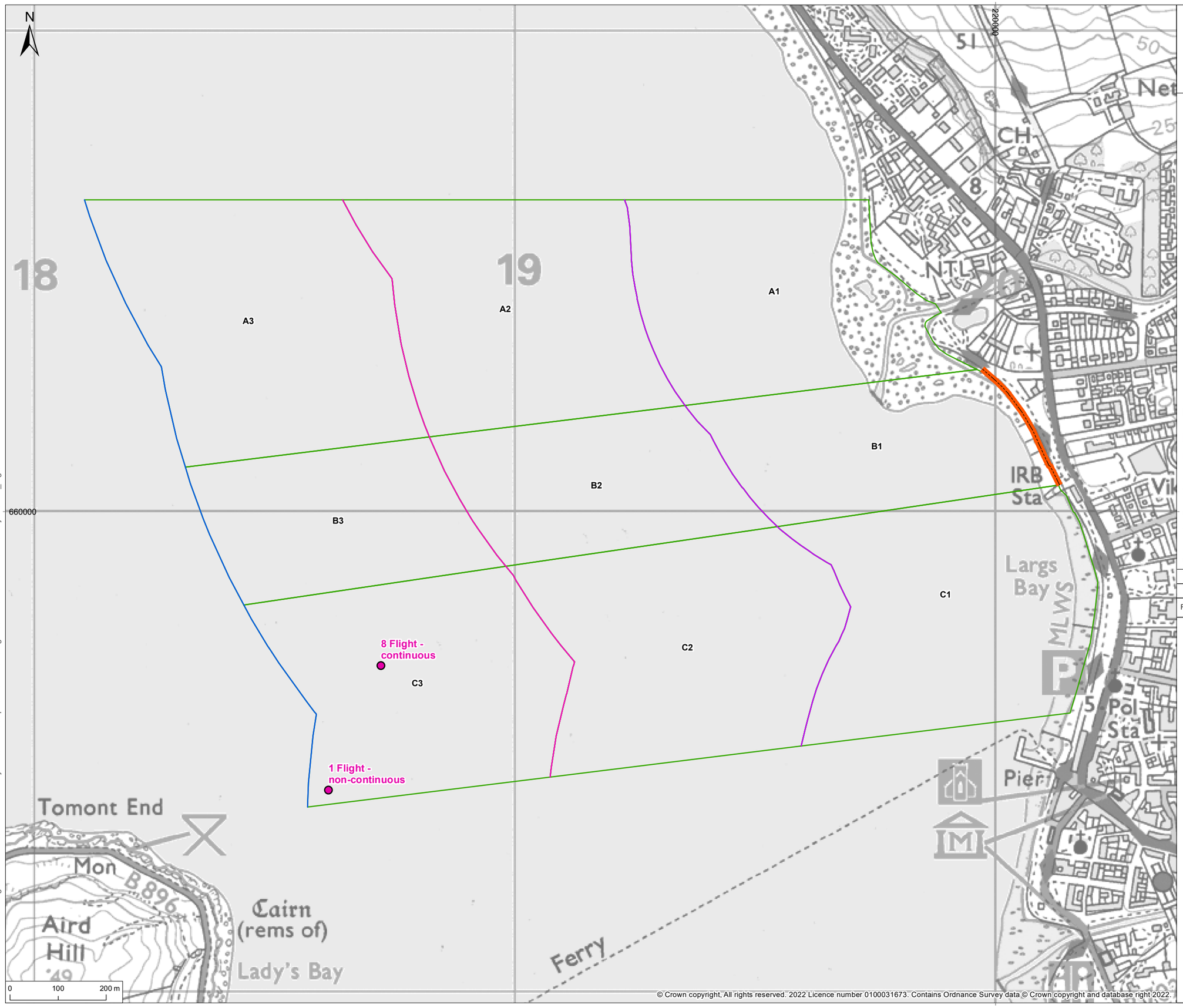
Figure Number: **3.12**

Rev: -

rpsgroup.com

© Crown copyright, All rights reserved. 2022 Licence number 0100031673. Contains Ordnance Survey data © Crown copyright and database right 2022.

W:\ECO01851 - RPS Belf Largs Sea Wall Intertidal Bird Surveys\Technical\Graphics\GIS\MXDs\Figures\ECO01851-0001-02 Survey Results_Fig3.mxd

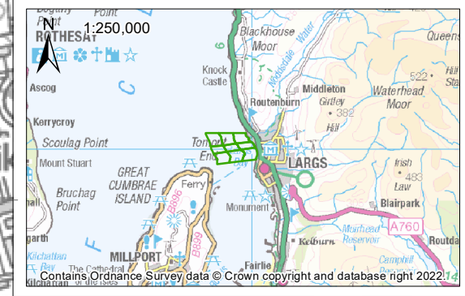


© 2022 RPS Group

Notes
1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.

Legend

- Sea Wall - Improvement Area
- Sector boundaries
- 0.5 km from shore
- 1.0 km from shore
- 1.5 km from shore
- Tidal bird count



Rev	Description	By	CB	Date

MAKING COMPLEX EASY

Atholl Exchange, 1st Floor, 6 Canning Street, Edinburgh EH3 8EG
T: +44(0)131 555 5011 E: rpsed2@rpsgroup.com

Client: North Ayrshire Council

Project: Largs Sea Wall Improvements

Title: Intertidal Breeding Bird Surveys: Greylag Goose

Status	Drawn By	PM/Checked By
FINAL	KAG	SZ

Project Number	Scale @ A3	Date Created
ECO01851	1:7,500	JAN 2022

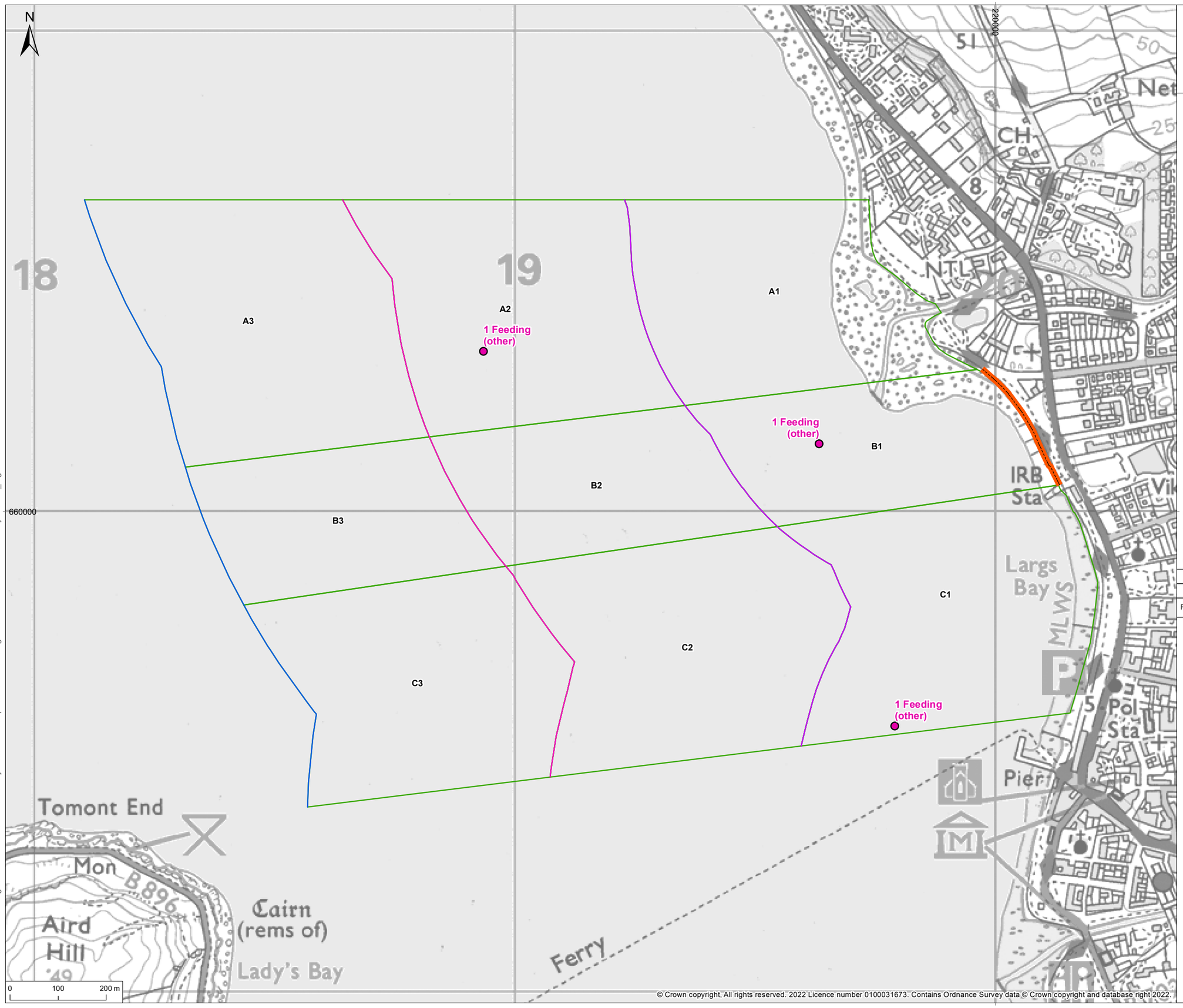
Figure Number: **3.13**

Rev: -

rpsgroup.com

© Crown copyright, All rights reserved. 2022 Licence number 0100031673. Contains Ordnance Survey data © Crown copyright and database right 2022.

W:\ECO01851 - RPS Belf Largs Sea Wall Intertidal Bird Surveys\Technical\Graphics\GIS\MXDs\Figures\ECO01851-0001-02 Survey Results_Fig3.mxd

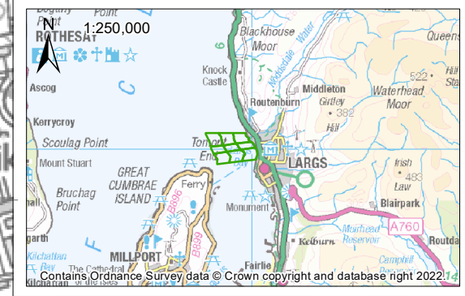


© 2022 RPS Group

Notes
1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.

Legend

- Sea Wall - Improvement Area
- Sector boundaries
- 0.5 km from shore
- 1.0 km from shore
- 1.5 km from shore
- Tidal bird count



Rev	Description	By	CB	Date

MAKING COMPLEX EASY

Atholl Exchange, 1st Floor, 6 Canning Street, Edinburgh EH3 8EG
T: +44(0)131 555 5011 E: rpsed2@rpsgroup.com

Client: North Ayrshire Council

Project: Largs Sea Wall Improvements

Title: Intertidal Breeding Bird Surveys: Guillemot

Status	Drawn By	PM/Checked By
FINAL	KAG	SZ

Project Number	Scale @ A3	Date Created
ECO01851	1:7,500	JAN 2022

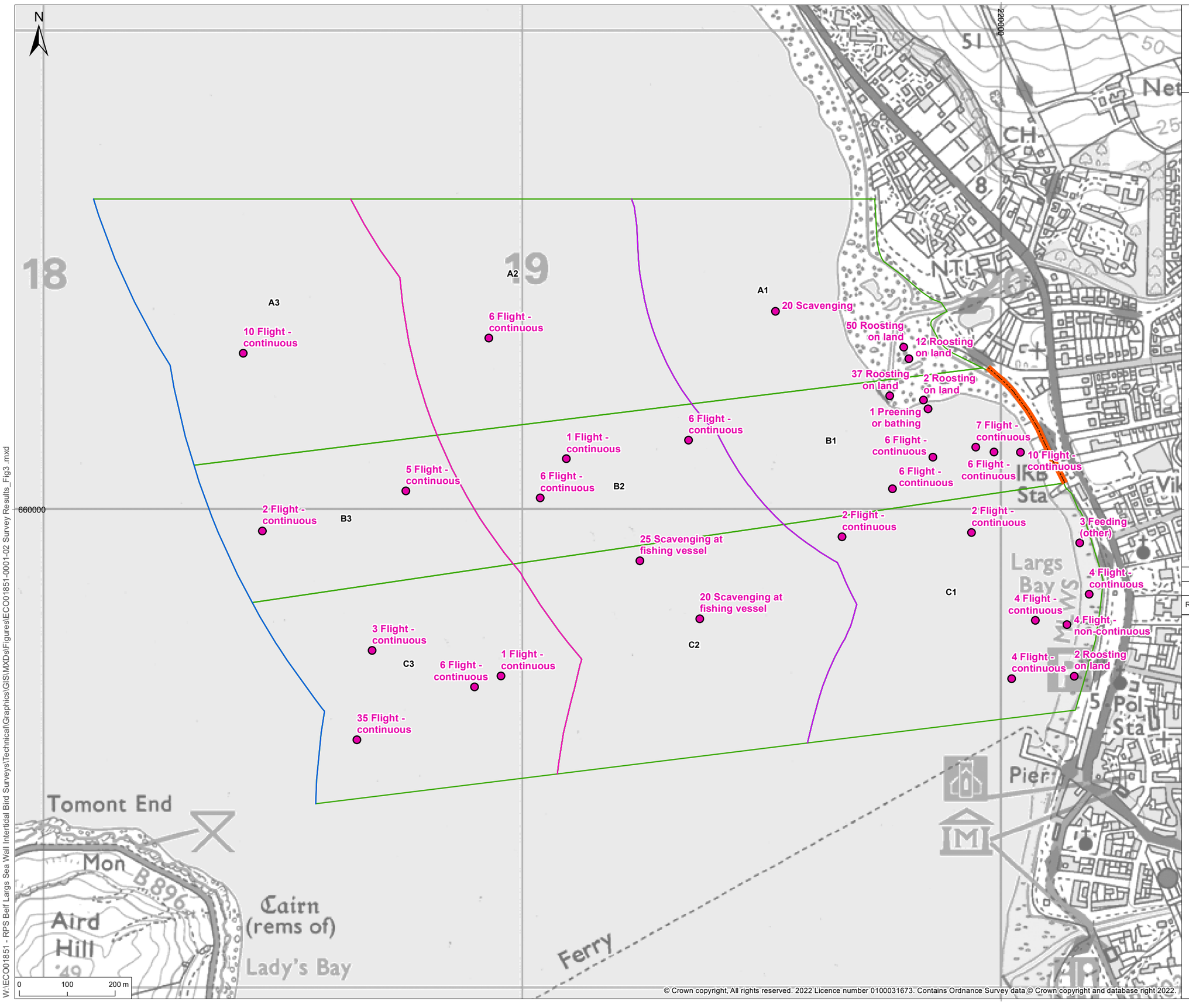
Figure Number: **3.14**

Rev: -

rpsgroup.com

© Crown copyright, All rights reserved. 2022 Licence number 0100031673. Contains Ordnance Survey data © Crown copyright and database right 2022.

W:\ECO01851 - RPS Belf Largs Sea Wall Intertidal Bird Surveys\Technical\Graphics\GIS\MXDs\Figures\ECO01851-0001-02 Survey Results_Fig3.mxd

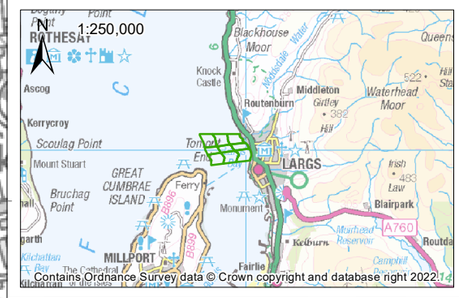


© 2022 RPS Group

Notes
1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.

Legend

- Sea Wall - Improvement Area
- Sector boundaries
- 0.5 km from shore
- 1.0 km from shore
- 1.5 km from shore
- Tidal bird count



Rev	Description	By	CB	Date

MAKING COMPLEX EASY

Atholl Exchange, 1st Floor, 6 Canning Street, Edinburgh EH3 8EG
T: +44(0)131 555 5011 E: rpsed2@rpsgroup.com

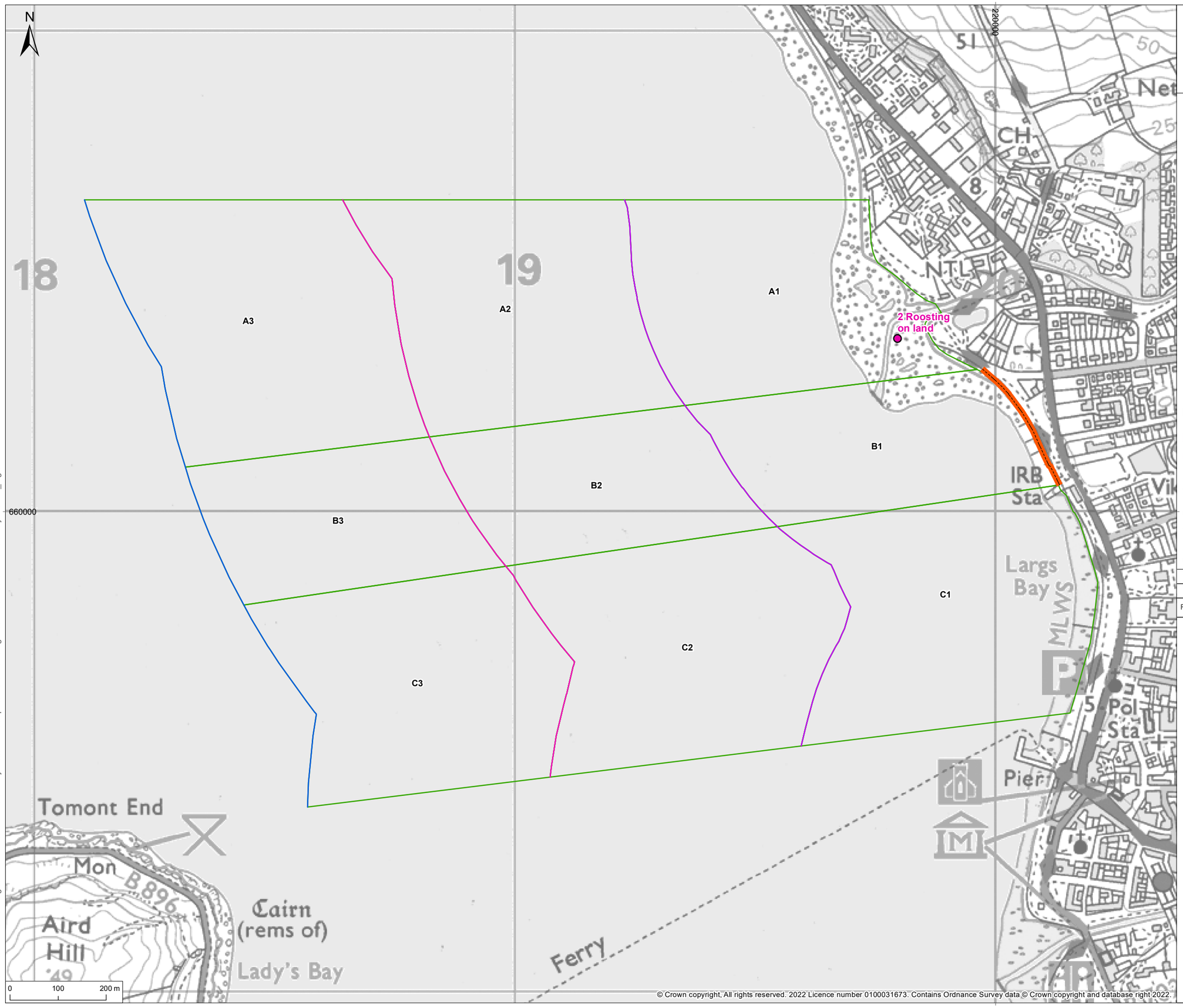
Client	North Ayrshire Council
Project	Largs Sea Wall Improvements
Title	Intertidal Breeding Bird Surveys: Herring Gull

Status	Drawn By	PM/Checked By
FINAL	KAG	SZ
Project Number	**Scale @ A3**	**Date Created**
ECO01851	1:7,500	JAN 2022
Figure Number		**Rev**
3.15		-

rpsgroup.com

© Crown copyright, All rights reserved. 2022 Licence number 0100031673. Contains Ordnance Survey data © Crown copyright and database right 2022.

W:\ECO01851 - RPS Bell Largs Sea Wall Intertidal Bird Surveys\Technical\Graphics\GIS\MXDs\Figures\ECO01851-0001-02 Survey Results_Fig3.mxd

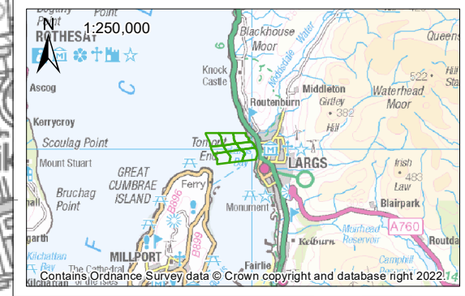


© 2022 RPS Group

Notes
1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.

Legend

- Sea Wall - Improvement Area
- Sector boundaries
- 0.5 km from shore
- 1.0 km from shore
- 1.5 km from shore
- Tidal bird count



Rev	Description	By	CB	Date

MAKING COMPLEX EASY

Atholl Exchange, 1st Floor, 6 Canning Street, Edinburgh EH3 8EG
T: +44(0)131 555 5011 E: rpsed2@rpsgroup.com

Client: North Ayrshire Council

Project: Largs Sea Wall Improvements

Title: Intertidal Breeding Bird Surveys: Kittiwake

Status	Drawn By	PM/Checked By
FINAL	KAG	SZ

Project Number	Scale @ A3	Date Created
ECO01851	1:7,500	JAN 2022

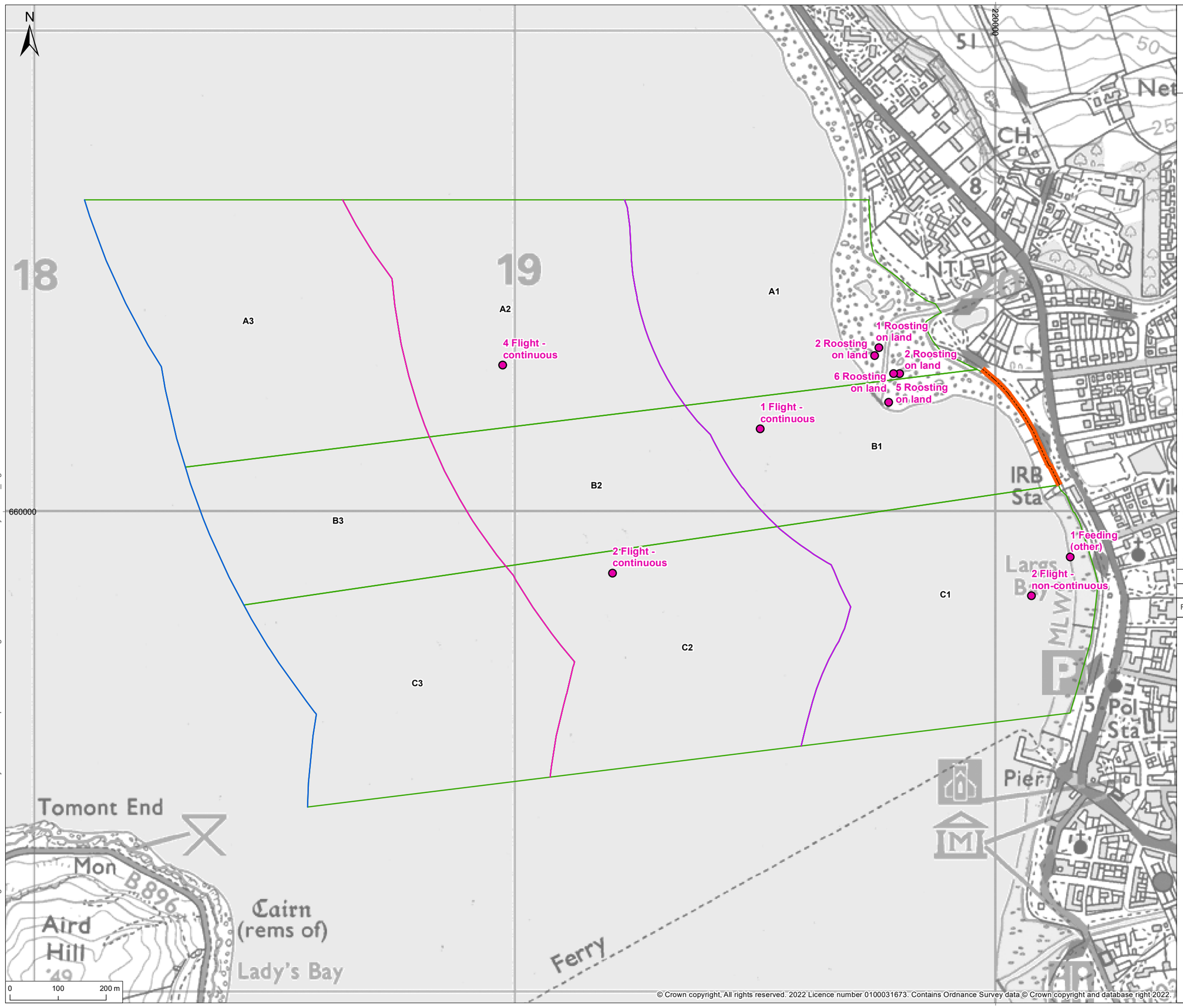
Figure Number: **3.16**

Rev: -

rpsgroup.com

© Crown copyright, All rights reserved. 2022 Licence number 0100031673. Contains Ordnance Survey data © Crown copyright and database right 2022.

W:\ECO01851 - RPS Belf Largs Sea Wall Intertidal Bird Surveys\Technical\Graphics\GIS\MXDs\Figures\ECO01851-0001-02 Survey Results_Fig3.mxd

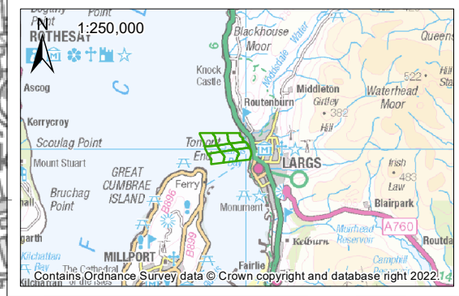


© 2022 RPS Group

Notes
1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.

Legend

- Sea Wall - Improvement Area
- Sector boundaries
- 0.5 km from shore
- 1.0 km from shore
- 1.5 km from shore
- Tidal bird count



Rev	Description	By	CB	Date

Atholl Exchange, 1st Floor, 6 Canning Street, Edinburgh EH3 8EG
T: +44(0)131 555 5011 E: rpsed2@rpsgroup.com

Client	North Ayrshire Council
Project	Largs Sea Wall Improvements
Title	Intertidal Breeding Bird Surveys: Lesser Black-backed Gull

Status	Drawn By	PM/Checked By
FINAL	KAG	SZ
Project Number	**Scale @ A3**	**Date Created**
ECO01851	1:7,500	JAN 2022
Figure Number		**Rev**
3.17		-

rpsgroup.com

© Crown copyright, All rights reserved. 2022 Licence number 0100031673. Contains Ordnance Survey data © Crown copyright and database right 2022.

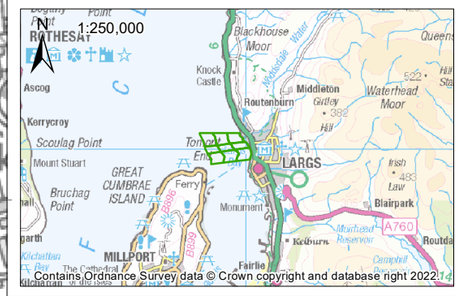
W:\ECO01851 - RPS Belf Largs Sea Wall Intertidal Bird Surveys\Technical\Graphics\GIS\MXDs\Figures\ECO01851-0001-02 Survey Results_Fig3.mxd

© 2022 RPS Group

Notes
1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.

Legend

- Sea Wall - Improvement Area
- Sector boundaries
- 0.5 km from shore
- 1.0 km from shore
- 1.5 km from shore
- Tidal bird count



Rev	Description	By	CB	Date

MAKING COMPLEX EASY

Atholl Exchange, 1st Floor, 6 Canning Street, Edinburgh EH3 8EG
T: +44(0)131 555 5011 E: rpsed2@rpsgroup.com

Client	North Ayrshire Council
Project	Largs Sea Wall Improvements
Title	Intertidal Breeding Bird Surveys: Mallard

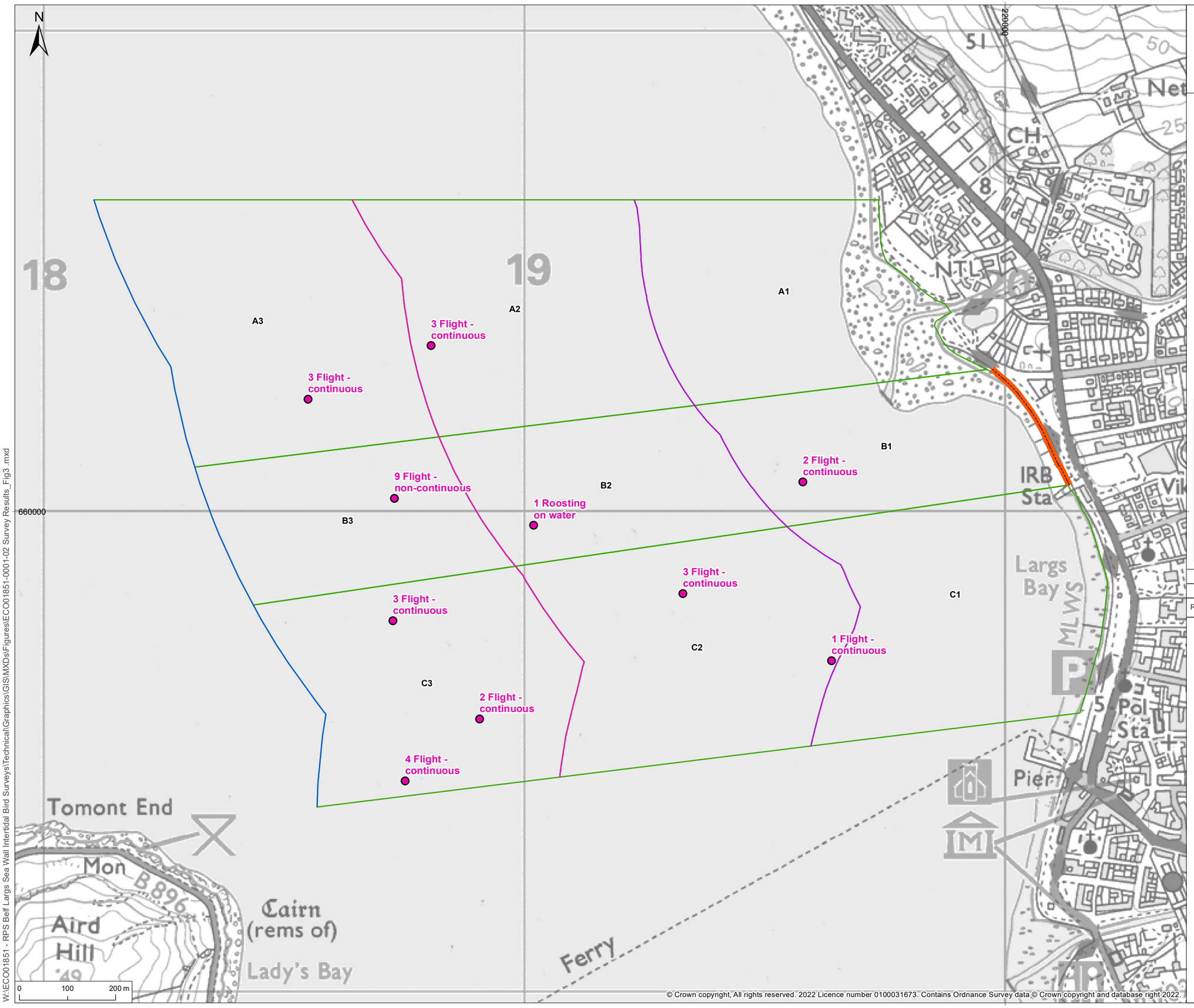
Status	Drawn By	PM/Checked By
FINAL	KAG	SZ
Project Number	**Scale @ A3**	**Date Created**
ECO01851	1:7,500	JAN 2022
Figure Number		**Rev**
3.18		**-**

rpsgroup.com

N
220000
660000
18
19
A1
A2
A3
B1
B2
B3
C1
C2
C3
4 Flight - continuous
1 Feeding (other)
1 Roosting on land
21 Feeding (other)
3 Flight - non-continuous
1 Flight - continuous
Tomont End
Mon
B896
Aird Hill
Cairn (rems of)
Lady's Bay
Ferry
Largs Bay
MLWS
IRB Sta
Pier
Pol Sta
0 100 200 m

© Crown copyright, All rights reserved. 2022 Licence number 0100031673. Contains Ordnance Survey data © Crown copyright and database right 2022.

W:\ECO01851 - RPS Belf Largs Sea Wall Intertidal Bird Surveys\Technical\Graphics\GIS\MXDs\Figures\ECO01851-0001-02 Survey Results_Fig3.mxd



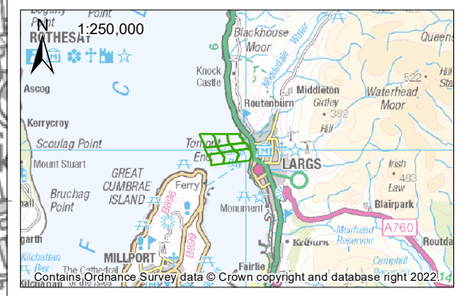
© Crown copyright, All rights reserved. 2022 Licence number 0100031673. Contains Ordnance Survey data © Crown copyright and database right 2022.

© 2022 RPS Group

Notes
1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.

Legend

- Sea Wall - Improvement Area
- Sector boundaries
- 0.5 km from shore
- 1.0 km from shore
- 1.5 km from shore
- Tidal bird count



Rev	Description	By	CB	Date

MAKING COMPLEX EASY

Atholl Exchange, 1st Floor, 6 Canning Street, Edinburgh EH3 8EG
T: +44(0)131 555 5011 E: rpsed2@rpsgroup.com

Client	North Ayrshire Council
Project	Largs Sea Wall Improvements
Title	Intertidal Breeding Bird Surveys: Manx Shearwater

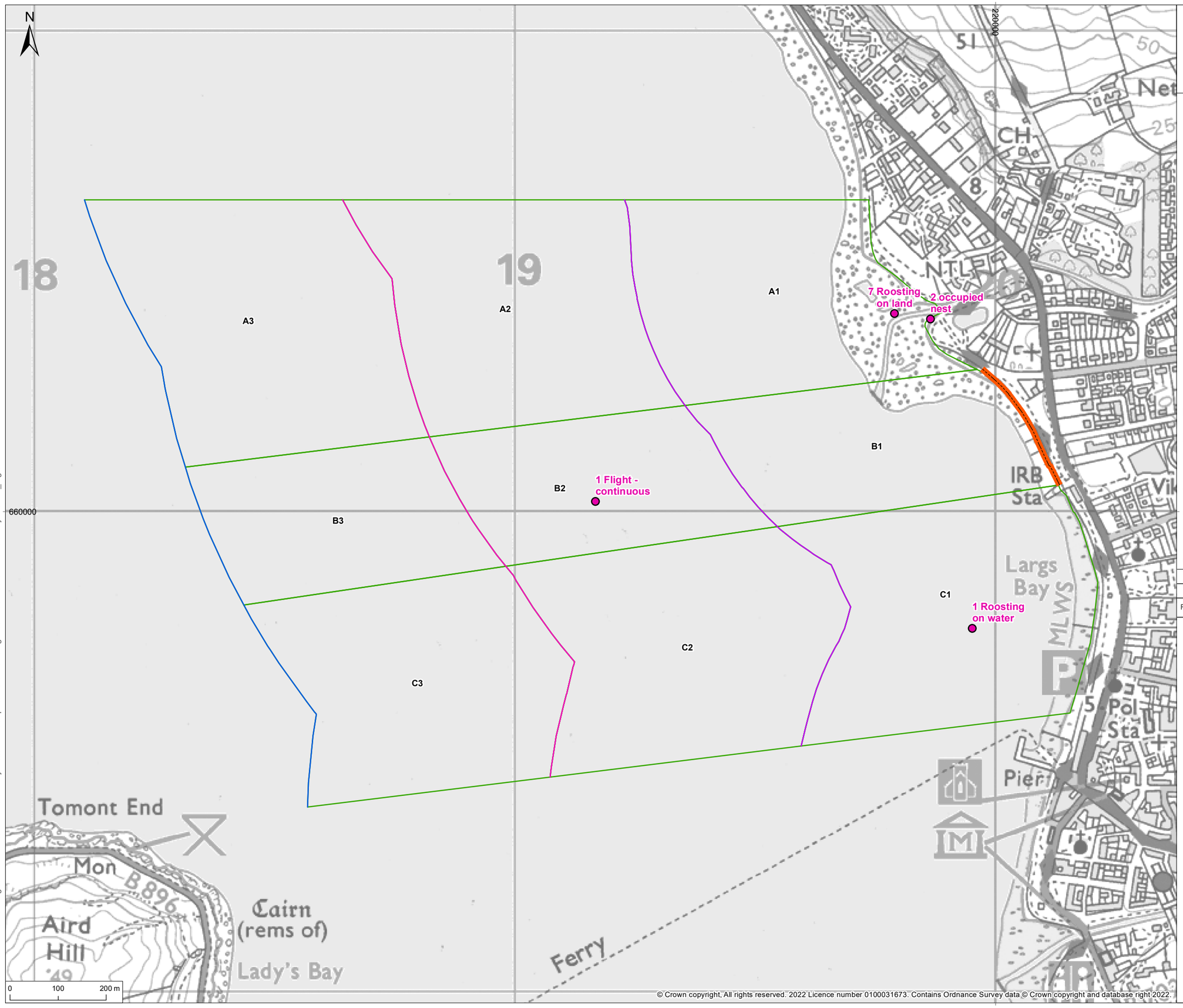
Status	Drawn By	PM/Checked By
FINAL	KAG	SZ

Project Number	Scale @ A3	Date Created
ECO01851	1:7,500	JAN 2022

Figure Number	Rev
3.19	-

rpsgroup.com

W:\ECO01851 - RPS Bell Largs Sea Wall Intertidal Bird Surveys\Technical\Graphics\GIS\MXDs\Figures\ECO01851-0001-02 Survey Results_Fig3.mxd

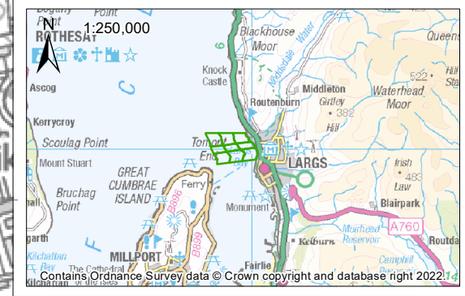


© 2022 RPS Group

Notes
1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.

Legend

- Sea Wall - Improvement Area
- Sector boundaries
- 0.5 km from shore
- 1.0 km from shore
- 1.5 km from shore
- Tidal bird count



Rev	Description	By	CB	Date

MAKING COMPLEX EASY

Atholl Exchange, 1st Floor, 6 Canning Street, Edinburgh EH3 8EG
T: +44(0)131 555 5011 E: rpsed2@rpsgroup.com

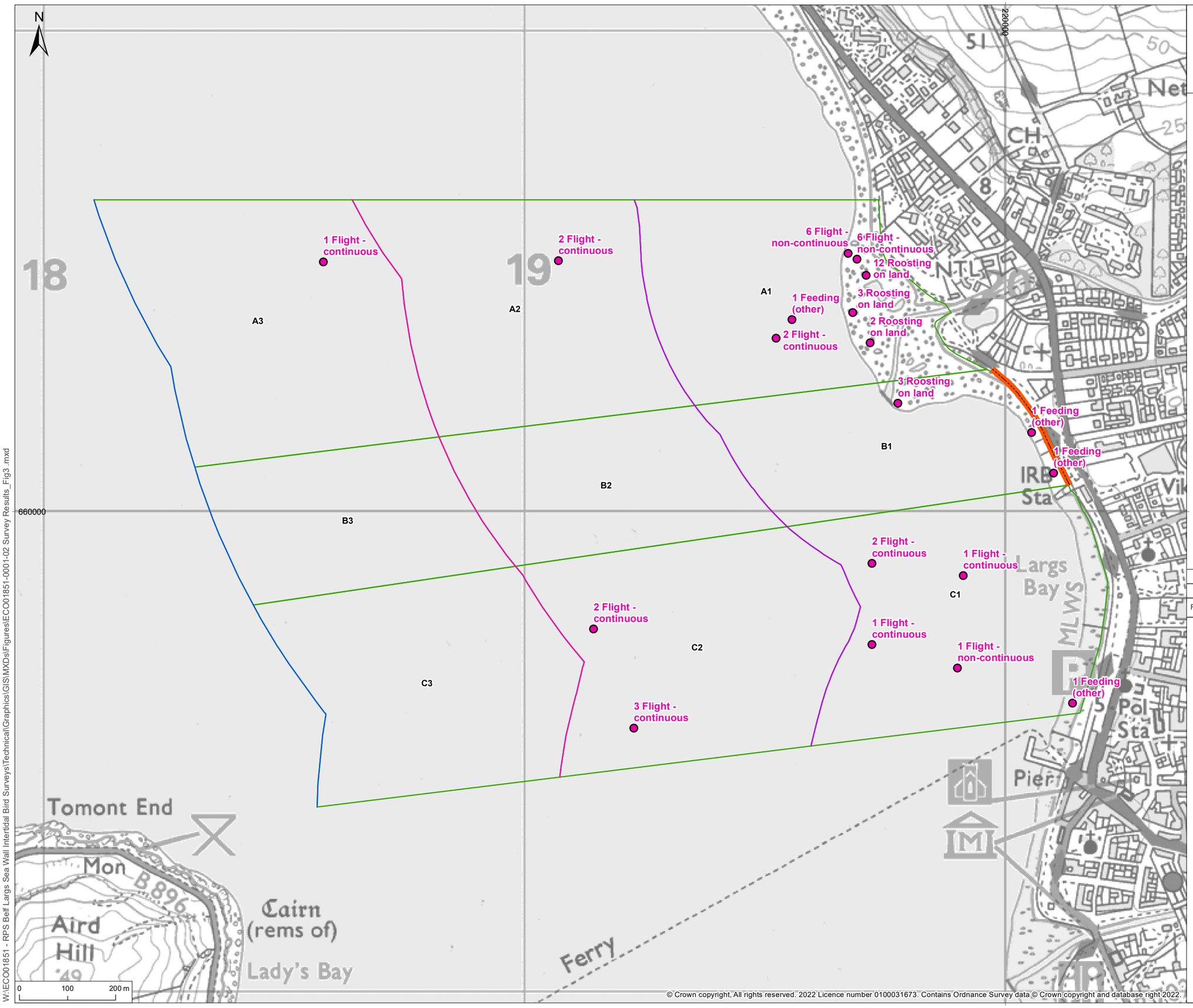
Client	North Ayrshire Council
Project	Largs Sea Wall Improvements
Title	Intertidal Breeding Bird Surveys: Mute Swan

Status	Drawn By	PM/Checked By
FINAL	KAG	SZ
Project Number	**Scale @ A3**	**Date Created**
ECO01851	1:7,500	JAN 2022
Figure Number		**Rev**
3.20		-

rpsgroup.com

© Crown copyright, All rights reserved. 2022 Licence number 0100031673. Contains Ordnance Survey data © Crown copyright and database right 2022.

W:\ECO01851 - RPS Belf Largs Sea Wall Intertidal Bird Surveys\Technical\Graphics\GIS\MXDs\Figures\ECO01851-0001-02 Survey Results_Fig3.mxd

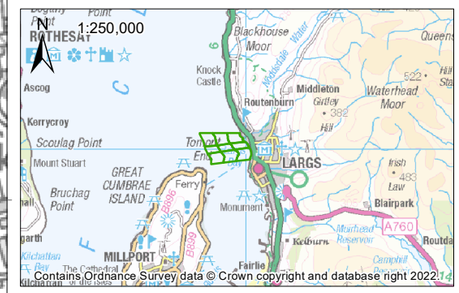


© 2022 RPS Group

Notes
1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.

Legend

- Sea Wall - Improvement Area
- Sector boundaries
- 0.5 km from shore
- 1.0 km from shore
- 1.5 km from shore
- Tidal bird count



Rev	Description	By	CB	Date

MAKING COMPLEX EASY

Atholl Exchange, 1st Floor, 6 Canning Street, Edinburgh EH3 8EG
T: +44(0)131 555 5011 E: rpsed2@rpsgroup.com

Client	North Ayrshire Council
Project	Largs Sea Wall Improvements
Title	Intertidal Breeding Bird Surveys: Oystercatcher

Status	Drawn By	PM/Checked By
FINAL	KAG	SZ

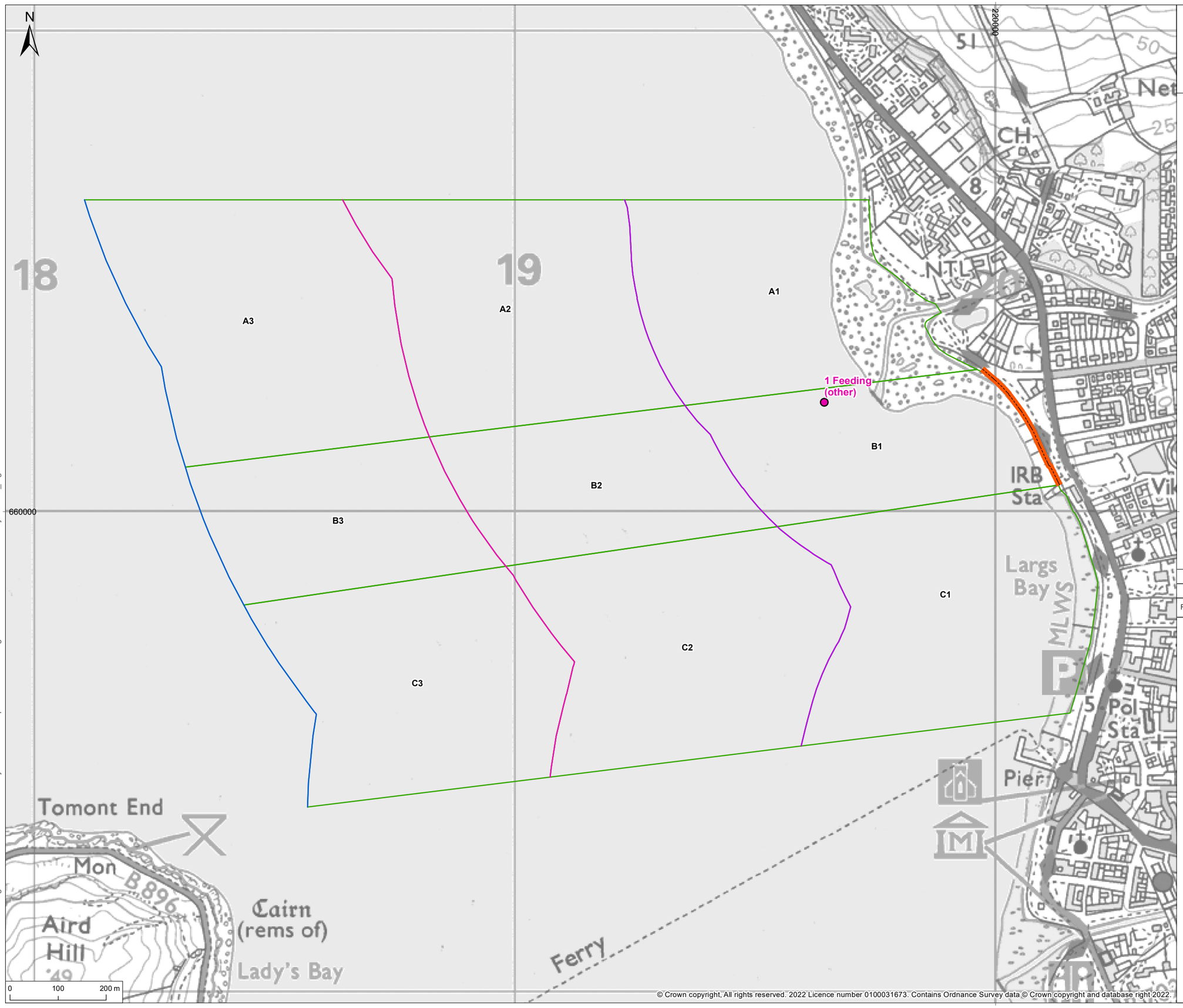
Project Number	Scale @ A3	Date Created
ECO01851	1:7,500	JAN 2022

Figure Number	Rev
3.21	-

rpsgroup.com

© Crown copyright, All rights reserved. 2022 Licence number 0100031673. Contains Ordnance Survey data © Crown copyright and database right 2022.

W:\ECO01851 - RPS Belf Largs Sea Wall Intertidal Bird Surveys\Technical\Graphics\GIS\MXDs\Figures\ECO01851-0001-02 Survey Results_Fig3 .mxd

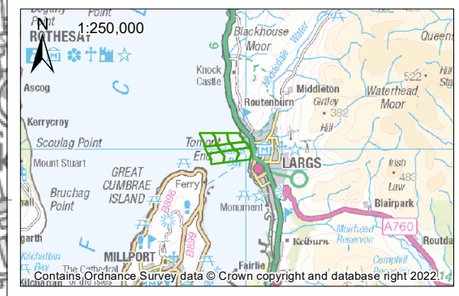


© 2022 RPS Group

Notes
1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.

Legend

- Sea Wall - Improvement Area
- Sector boundaries
- 0.5 km from shore
- 1.0 km from shore
- 1.5 km from shore
- Tidal bird count



Rev	Description	By	CB	Date

MAKING COMPLEX EASY

Atholl Exchange, 1st Floor, 6 Canning Street, Edinburgh EH3 8EG
T: +44(0)131 555 5011 E: rpsed2@rpsgroup.com

Client: North Ayrshire Council

Project: Largs Sea Wall Improvements

Title: Intertidal Breeding Bird Surveys: Red-breasted Merganser

Status	Drawn By	PM/Checked By
FINAL	KAG	SZ

Project Number	Scale @ A3	Date Created
ECO01851	1:7,500	JAN 2022

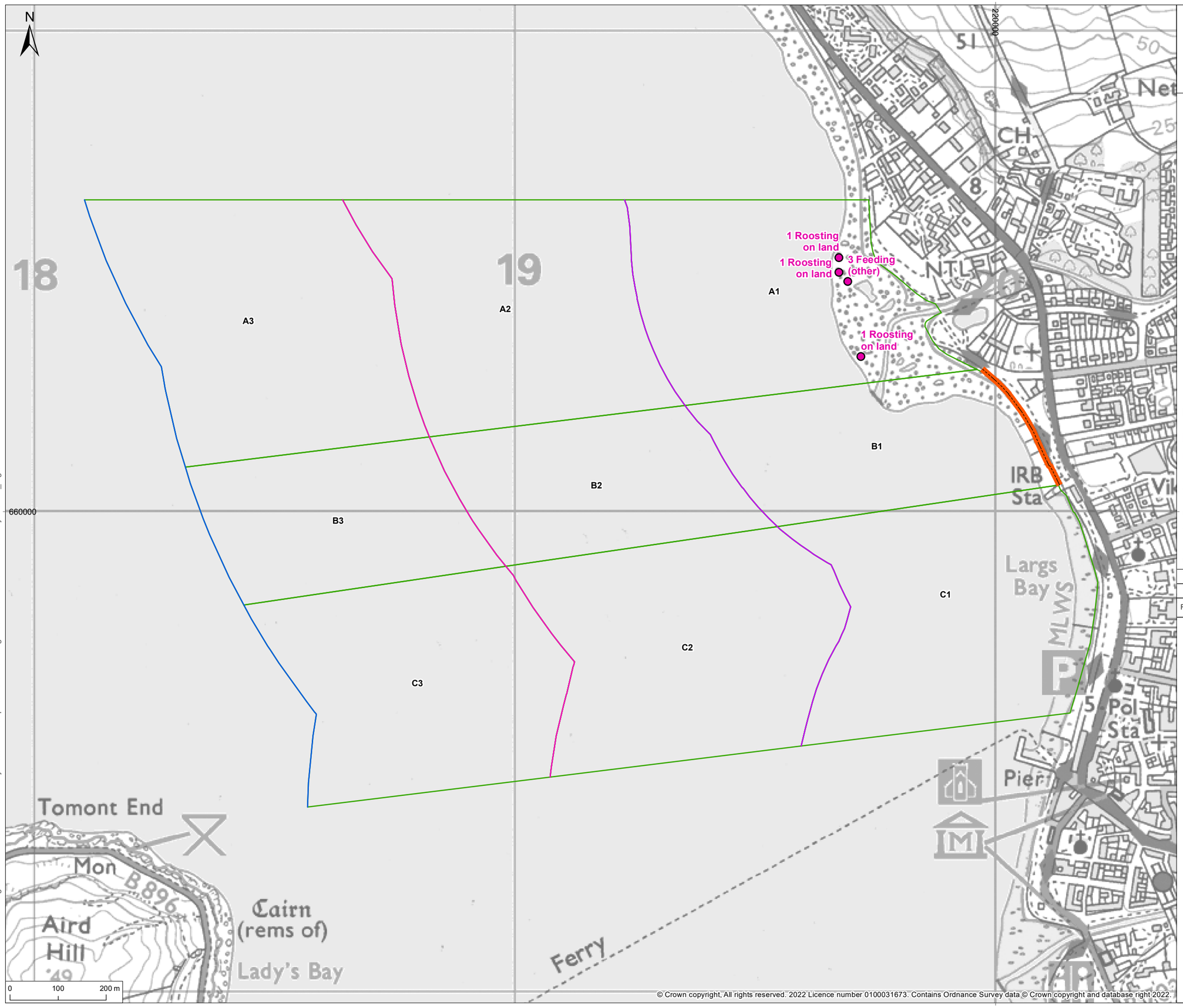
Figure Number: **3.22**

Rev: -

rpsgroup.com

© Crown copyright, All rights reserved. 2022 Licence number 0100031673. Contains Ordnance Survey data © Crown copyright and database right 2022.

W:\ECO01851 - RPS Belf Largs Sea Wall Intertidal Bird Surveys\Technical\Graphics\GIS\MXDs\Figures\ECO01851-0001-02 Survey Results_Fig3.mxd

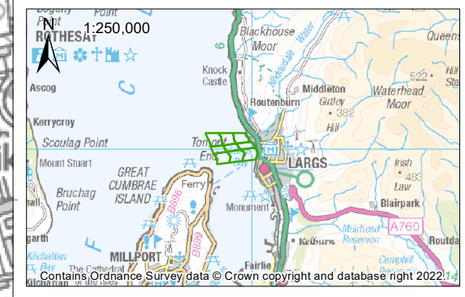


© 2022 RPS Group

Notes
1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.

Legend

- Sea Wall - Improvement Area
- Sector boundaries
- 0.5 km from shore
- 1.0 km from shore
- 1.5 km from shore
- Tidal bird count



Rev	Description	By	CB	Date

MAKING COMPLEX EASY

Atholl Exchange, 1st Floor, 6 Canning Street, Edinburgh EH3 8EG
T: +44(0)131 555 5011 E: rpsed2@rpsgroup.com

Client: North Ayrshire Council

Project: Largs Sea Wall Improvements

Title: Intertidal Breeding Bird Surveys: Ringed Plover

Status	Drawn By	PM/Checked By
FINAL	KAG	SZ

Project Number	Scale @ A3	Date Created
ECO01851	1:7,500	JAN 2022

Figure Number: **3.23**

Rev: -

rpsgroup.com

© Crown copyright, All rights reserved. 2022 Licence number 0100031673. Contains Ordnance Survey data © Crown copyright and database right 2022.

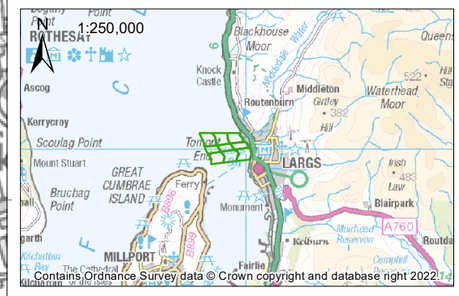
W:\ECO01851 - RPS Belf Largs Sea Wall Intertidal Bird Surveys\Technical\Graphics\GIS\MXDs\Figures\ECO01851-0001-02 Survey Results_Fig3.mxd

© 2022 RPS Group

Notes
1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.

Legend

- Sea Wall - Improvement Area
- Sector boundaries
- 0.5 km from shore
- 1.0 km from shore
- 1.5 km from shore
- Tidal bird count



Rev	Description	By	CB	Date

rps MAKING COMPLEX EASY

Atholl Exchange, 1st Floor, 6 Canning Street, Edinburgh EH3 8EG
T: +44(0)131 555 5011 E: rpsed2@rpsgroup.com

Client: North Ayrshire Council

Project: Largs Sea Wall Improvements

Title: Intertidal Breeding Bird Surveys: Sandwich Tern

Status	Drawn By	PM/Checked By
FINAL	KAG	SZ

Project Number	Scale @ A3	Date Created
ECO01851	1:7,500	JAN 2022

Figure Number: **3.24**

Rev: -

rpsgroup.com

N

18 19

A1 A2 A3 B1 B2 B3 C1 C2 C3

2 Feeding (other)

2 Feeding (other)

220000

660000

Tomont End

Mon

B896

Aird Hill

Cairn (rems of)

Lady's Bay

Ferry

IRB Sta

Largs Bay

MLWS

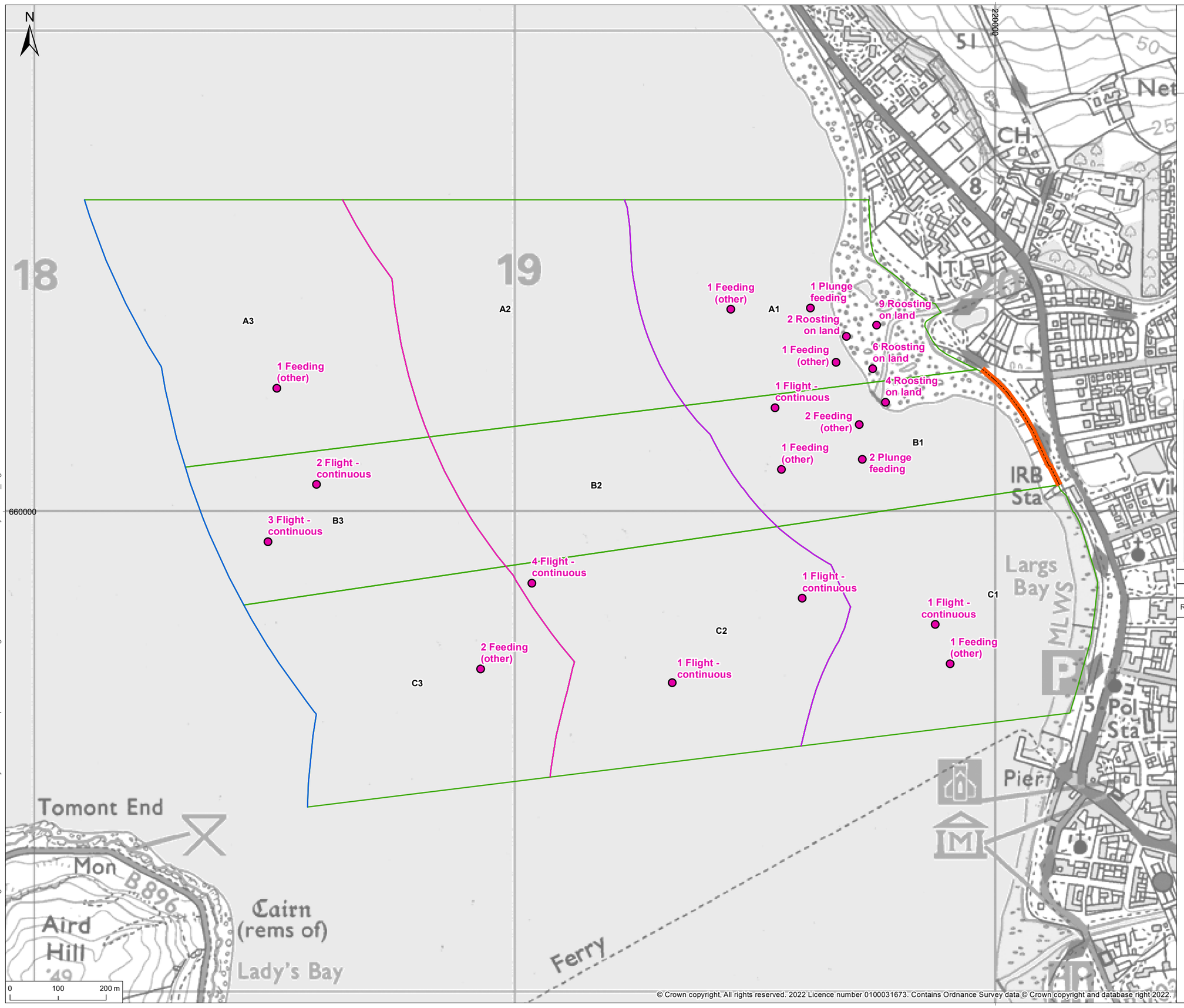
Pol Sta

Pier

0 100 200 m

© Crown copyright, All rights reserved. 2022 Licence number 0100031673. Contains Ordnance Survey data © Crown copyright and database right 2022.

W:\ECO01851 - RPS Belf Largs Sea Wall Intertidal Bird Surveys\Technical\Graphics\GIS\MXDs\Figures\ECO01851-0001-02 Survey Results_Fig3.mxd



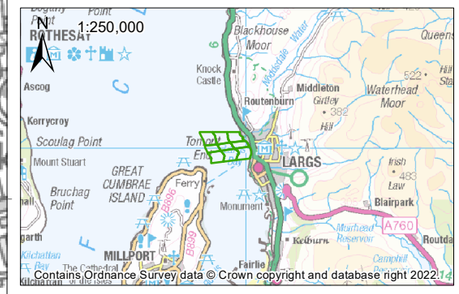
© Crown copyright, All rights reserved. 2022 Licence number 0100031673. Contains Ordnance Survey data © Crown copyright and database right 2022.

© 2022 RPS Group

Notes
1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.

Legend

- Sea Wall - Improvement Area
- Sector boundaries
- 0.5 km from shore
- 1.0 km from shore
- 1.5 km from shore
- Tidal bird count



Rev	Description	By	CB	Date

MAKING COMPLEX EASY

Atholl Exchange, 1st Floor, 6 Canning Street, Edinburgh EH3 8EG
T: +44(0)131 555 5011 E: rpsed2@rpsgroup.com

Client: North Ayrshire Council

Project: Largs Sea Wall Improvements

Title: Intertidal Breeding Bird Surveys: Shag

Status	Drawn By	PM/Checked By
FINAL	KAG	SZ

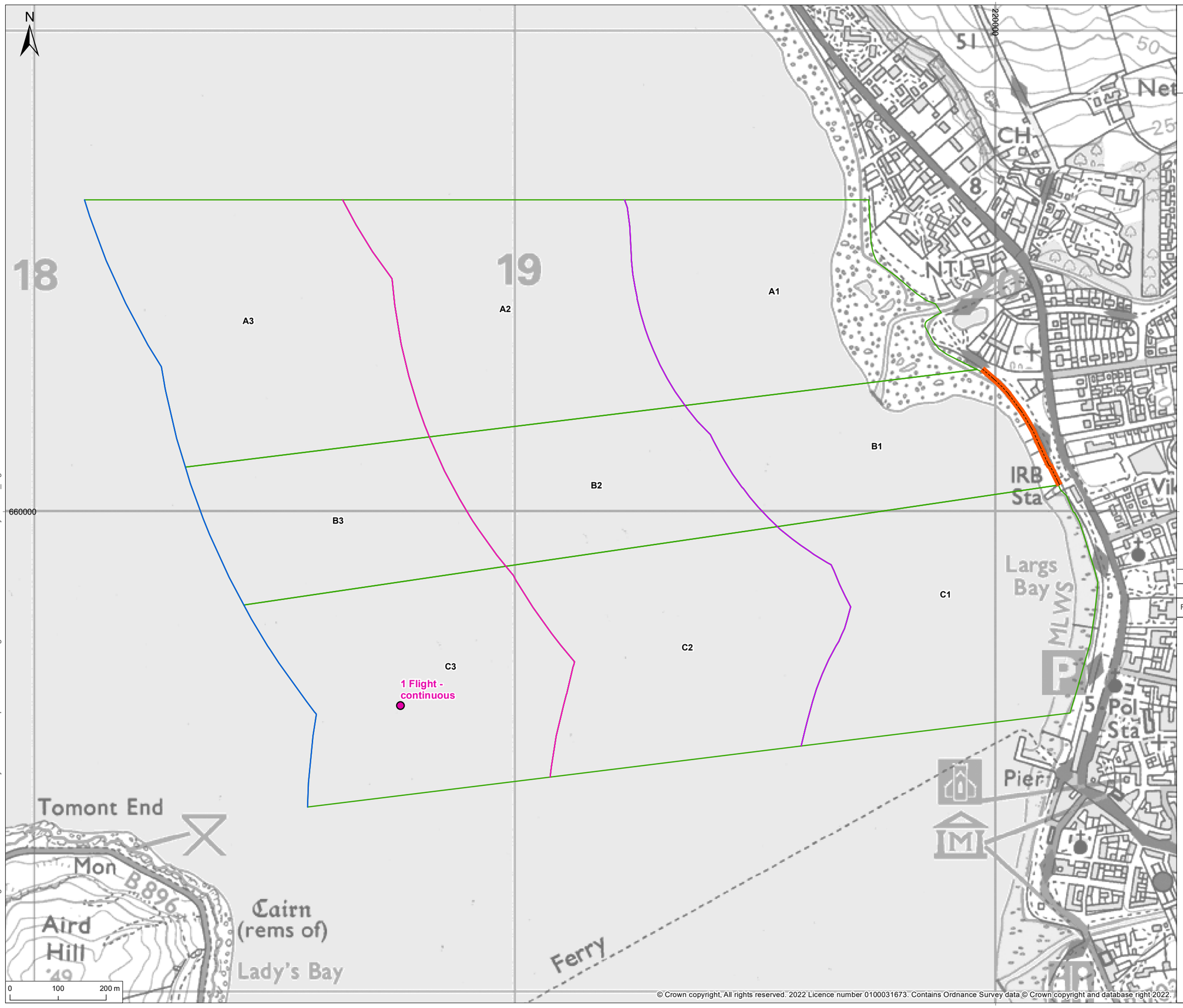
Project Number	Scale @ A3	Date Created
ECO01851	1:7,500	JAN 2022

Figure Number: **3.25**

Rev: -

rpsgroup.com

W:\ECO01851 - RPS Bell Largs Sea Wall Intertidal Bird Surveys\Technical\Graphics\GIS\MXDs\Figures\ECO01851-0001-02 Survey Results_Fig3.mxd

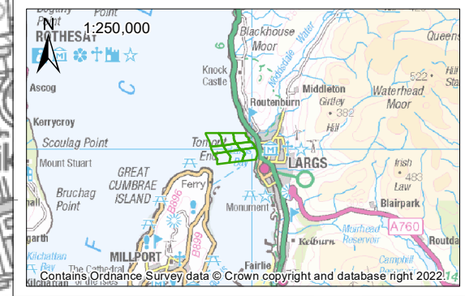


© 2022 RPS Group

Notes
1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.

Legend

- Sea Wall - Improvement Area
- Sector boundaries
- 0.5 km from shore
- 1.0 km from shore
- 1.5 km from shore
- Tidal bird count



Rev	Description	By	CB	Date

Atholl Exchange, 1st Floor, 6 Canning Street, Edinburgh EH3 8EG
T: +44(0)131 555 5011 E: rpsed2@rpsgroup.com

Client	North Ayrshire Council
Project	Largs Sea Wall Improvements
Title	Intertidal Breeding Bird Surveys: Shelduck

Status	Drawn By	PM/Checked By
FINAL	KAG	SZ
Project Number	**Scale @ A3**	**Date Created**
ECO01851	1:7,500	JAN 2022
Figure Number		**Rev**
3.26		-

rpsgroup.com

© Crown copyright, All rights reserved. 2022 Licence number 0100031673. Contains Ordnance Survey data © Crown copyright and database right 2022.

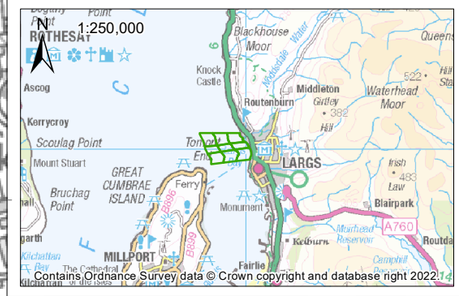
W:\ECO01851 - RPS Belf Largs Sea Wall Intertidal Bird Surveys\Technical\Graphics\GIS\MXDs\Figures\ECO01851-0001-02 Survey Results_Fig3.mxd

© 2022 RPS Group

Notes
1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.

Legend

- Sea Wall - Improvement Area
- Sector boundaries
- 0.5 km from shore
- 1.0 km from shore
- 1.5 km from shore
- Tidal bird count



Rev	Description	By	CB	Date

MAKING COMPLEX EASY

Atholl Exchange, 1st Floor, 6 Canning Street, Edinburgh EH3 8EG
T: +44(0)131 555 5011 E: rpsed2@rpsgroup.com

Client: North Ayrshire Council

Project: Largs Sea Wall Improvements

Title: Intertidal Breeding Bird Surveys: Turnstone

Status	Drawn By	PM/Checked By
FINAL	KAG	SZ

Project Number	Scale @ A3	Date Created
ECO01851	1:7,500	JAN 2022

Figure Number: **3.27**

Rev: -

rpsgroup.com

N

18 19

A1 A2 A3 B1 B2 B3 C1 C2 C3

5 Feeding (other)

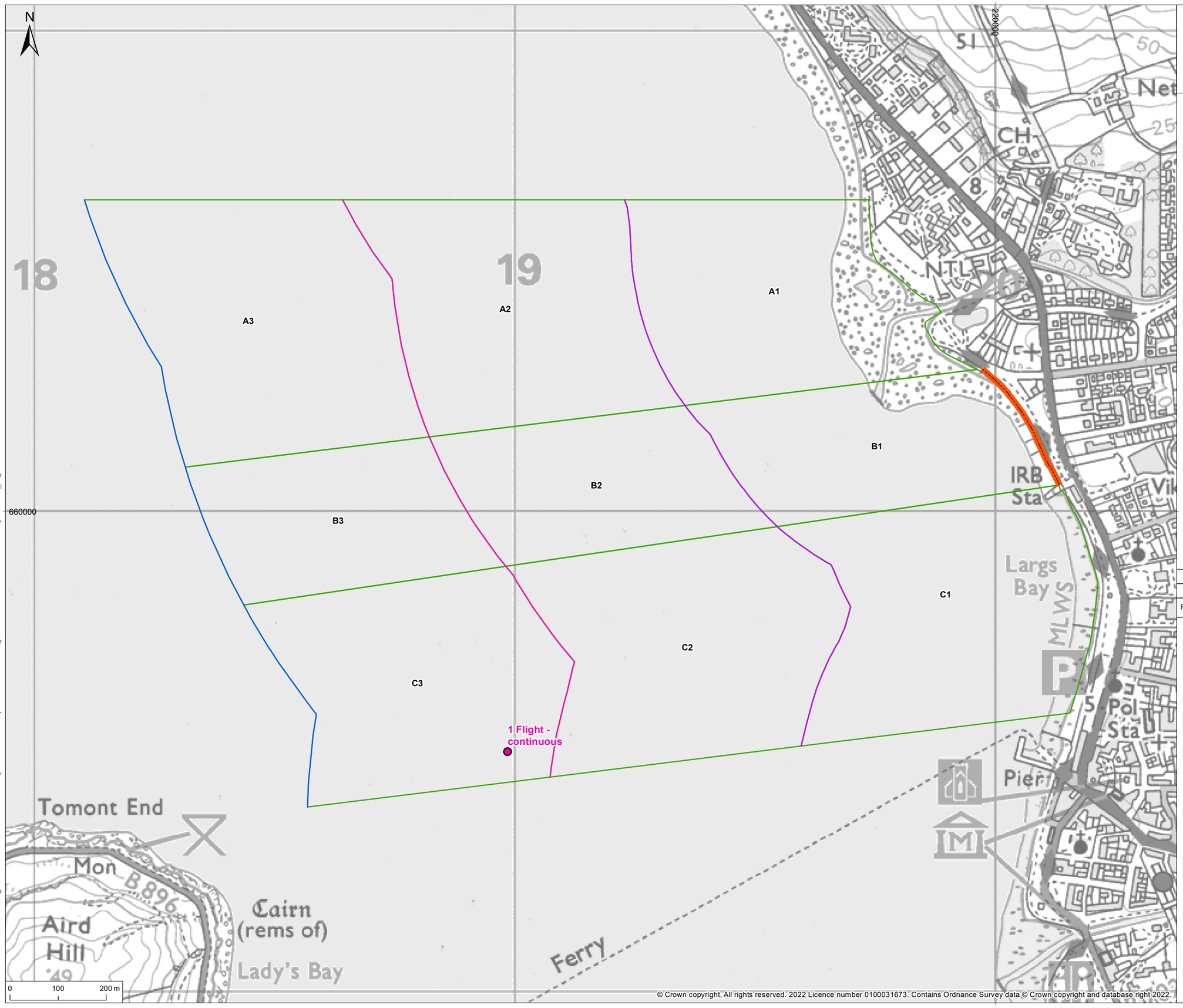
220000 660000

Tomont End
Mon
B896
Aird Hill
Cairn (rems of)
Lady's Bay
Ferry
IRB Sta
Largs Bay
MLWS
Pier
Pol Sta

0 100 200 m

© Crown copyright, All rights reserved. 2022 Licence number 0100031673. Contains Ordnance Survey data © Crown copyright and database right 2022.

W:\ECO01851 - RPS Belf Largs Sea Wall Intertidal Bird Surveys\Technical\Graphics\GIS\MXDs\Figures\ECO01851-0001-02 Survey Results_Fig3.mxd

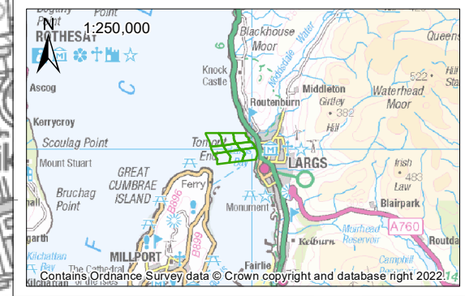


© 2022 RPS Group

Notes
1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.

Legend

- Sea Wall - Improvement Area
- Sector boundaries
- 0.5 km from shore
- 1.0 km from shore
- 1.5 km from shore
- Tidal bird count



Rev	Description	By	CB	Date

Atholl Exchange, 1st Floor, 6 Canning Street, Edinburgh EH3 8EG
T: +44(0)131 555 5011 E: rpsed2@rpsgroup.com

Client: North Ayrshire Council

Project: Largs Sea Wall Improvements

Title: Intertidal Breeding Bird Surveys: Whimbrel

Status	Drawn By	PM/Checked By
FINAL	KAG	SZ

Project Number	Scale @ A3	Date Created
ECO01851	1:7,500	JAN 2022

Figure Number: **3.28**

Rev: -

rpsgroup.com

© Crown copyright, All rights reserved. 2022 Licence number 0100031673. Contains Ordnance Survey data © Crown copyright and database right 2022.

W:\ECO01851 - RPS Belf Largs Sea Wall Intertidal Bird Surveys\Technical\Graphics\GIS\MXDs\Figures\ECO01851-0001-02 Survey Results_Fig3.mxd

Appendix E

Intertidal Survey Report

REPLACEMENT SEA WALL, LARGS

Intertidal Survey Report

EOME0507
Intertidal Survey Report
Version 01
20 May 2022

rpsgroup.com

Document status

Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
Rev00	Draft for Internal Review	M Carstairs	K Linnane & A Crowther	K Linnane	16/05/2022
Rev01	Draft Issued for Client Review	A Crowther	K Linnane	K Linnane	20/05/2022

Approval for issue

K Linnane 20 May 2022

The report has been prepared for the exclusive use and benefit of our client and solely for the purpose for which it is provided. Unless otherwise agreed in writing by RPS Group Plc, any of its subsidiaries, or a related entity (collectively 'RPS') no part of this report should be reproduced, distributed or communicated to any third party. RPS does not accept any liability if this report is used for an alternative purpose from which it is intended, nor to any third party in respect of this report. The report does not account for any changes relating to the subject matter of the report, or any legislative or regulatory changes that have occurred since the report was produced and that may affect the report.
The report has been prepared using the information provided to RPS by its client, or others on behalf of its client. To the fullest extent permitted by law, RPS shall not be liable for any loss or damage suffered by the client arising from fraud, misrepresentation, withholding of information material relevant to the report or required by RPS, or other default relating to such information, whether on the client's part or that of the other information sources, unless such fraud, misrepresentation, withholding or such other default is evident to RPS without further enquiry. It is expressly stated that no independent verification of any documents or information supplied by the client or others on behalf of the client has been made. The report shall be used for general information only.

Prepared by:

RPS

Max Carstairs

RPS Associate

Imagination House
Chepstow
NP16 5PB

T +44 [redacted]

E [redacted]

Prepared for:

North Ayrshire Council

George Cruickshank

Project Officer

Cunninghame House
Irvine
KA12 8EE

T +44 [redacted]

E [redacted]

Contents

1 INTRODUCTION 4

2 INTERTIDAL SURVEY 5
2.1 Methodology 5
2.1.1 Timing 5

3 SURVEY RESULTS 6
3.1 Overview 6
3.2 Biotopes 8
3.3 Observations in wider area 16

4 HABITATS OF CONSERVATION IMPORTANCE 17
4.1 Intertidal Sand and Mudflats 17
4.2 Other Biotopes 17

5 SUMMARY 18

6 REFERENCES 19

Appendices

Appendix A List of Biotopes in the Survey Area 20
Appendix B Target Notes 21

1 INTRODUCTION

The town of Largs is located within the Firth of Clyde in North Ayrshire, Scotland, and is a popular seaside resort. The town is protected by a sea wall located on the Largs Promenade which extends from the mouth of the Noddsdale Water southwards to Largs Harbour. The sea wall is located across a 300m stretch of beach north of the RNLI slipway.

Engineering surveys undertaken have indicated that the existing sea wall structure is deteriorating. Specifically, there is clear deterioration of the gunite facing concrete, where it remains attached to the existing wall face and high levels of corrosion of the existing wall reinforcement. The sea wall is also undermined along a section of wall (approx. 12m in length) where the toe is exposed and no sheet piles were installed. There is also deterioration to three sets of steps ranging in height from 1.8m to 3.1m located along the length of the sea wall. On this basis there is a need for the proposed sea wall replacement scheme which comprises the replacement/encapsulation of the existing 300m long sea wall.

This Phase 1 Intertidal Walkover Survey Report provides a characterisation of the benthic baseline environment from Mean High Water Springs (MHWS) to approximately Mean Low Water Springs (MLWS), and identifies sensitive ecological receptors present at the proposed location of the seawall replacement at Largs Bay, Ayrshire. The results of this survey will inform the Marine Biodiversity Assessment being undertaken for the proposed development as part of the Marine Licence application to Marine Scotland Licensing Operations Team (MS-LOT).

The structure of this report is as follows:

- **Section 2, Intertidal Survey**: this section provides a description of the methodology used to undertake the Phase 1 Intertidal Survey;
- **Section 3, Survey Results**: this section describes the results of the survey and classifies the environment by biotope;
- **Section 4, Habitats of Conservation Importance**: this section identifies which biotopes are of ecological and conservational importance; and
- **Section 5, Summary**: This section summaries the report.

2 INTERTIDAL SURVEY

2.1 Methodology

A Phase 1 walkover survey of the intertidal area in the vicinity of forthcoming seawall repairs at Largs Bay, Ayrshire was undertaken on 6 April 2022. The survey was carried out on a spring tide cycle and focussed on intertidal biotopes from MHWS to approximately MLWS. Tide data for the survey are presented in Table 2.1. The area of seawall repairs and a 50m buffer zone at either side was formally surveyed. In addition, a brief walkover survey extended approximately another 100m either side to check habitat continuity within the wider context of the beach.

The survey was undertaken with reference to standard intertidal survey methodologies as outlined in the Joint Nature Conservation Committee (JNCC) Marine Monitoring Handbook (Davies *et al*., 2001), Procedural Guidance No 3-1 *In situ* intertidal biotope recording (Wyn and Brazier, 2001 and Wyn *et al*., 2000), and The Handbook for Marine Intertidal Phase 1 Biotope Mapping Survey (Wyn *et al*., 2006).

The survey was carried out by experienced marine biotope and coastal habitat surveyor (Max Carstairs) with survey assistance and a health and safety presence from marine ecologist (Kat Majewska).

During the walkover survey, notes were made on the shore type, wave exposure, sediments/substrates present and descriptions of species/biotopes present (JNCC, 2015). The spatial relationships between these features were observed and waypoints were recorded by a hand-held global positioning system (GPS) device, in conjunction with hand-written descriptions and photographs. All biotopes present were identified, and their extents mapped with the aid of aerial photographs and a hand-held GPS recorder. Biotope mosaics have been mapped where a number of discrete biotopes occur intricately together. Any other features within the intertidal zone were also noted including, man-made structures, and any habitats/species of conservation importance. Where present, these features were target noted in the intertidal biotope map.

On-site sediment sieving was undertaken in different biotopes, where physically possible. The locations of sieving stations were determined in the field. The procedure involved the collection of four spade-loads (approximately 0.02 m^2) of sediment dug to a depth of 20-25 cm, which were then sieved through a series of stacked sieves, the finest of which was 0.5 mm mesh. All macrofauna species present were identified to the lowest taxonomic level possible in the field and also enumerated on site. Field notes were also taken on the physical characteristics including sediment type (Wentworth, 1922) and presence of anoxic layers in the sediment.

2.1.1 Timing

The fieldwork was undertaken on the 06 April 2022 during the optimal period for intertidal biotope survey mapping namely April – October (Wyn *et al*., 2006). Due to occurrence of low tide close to sunrise, surveying was undertaken before and after low water. Approximate low tide time and height for the survey are presented in Table 2.1.

Table 2.1: Tide Times and Daylight Hours for Intertidal Survey (based on times for Wemyss Bay). Tide Heights in Meters above Chart Datum, Times in BST.

Date	Start	Finish	Low tide	Height	Sunrise
06/04/2022	08:20	12:00	09:25	0.48m	06:36

3 SURVEY RESULTS

This section describes the results of the intertidal survey undertaken within the intertidal environment at Largs Bay, aiming to attribute biotopes to the species and habitats identified.

3.1 Overview

The survey site had a small tidal range with a narrow intertidal zone with a seawall constructed from concrete present at the head of the beach. Large slabs (25 cm - >1m) had fallen off the seawall and lay scattered around the intertidal zone.

Several species of flora and fauna indicated a low/variable salinity within the survey area, particularly towards the north of the site. The survey area contained a restricted array of commonly occurring species and biotopes (Figure 3.1). The biotope LS.LSa.St.Tal Talitrids dominated the upper shore and strand-line, giving way to a mosaic of 80% LR.MLR.BF.Fser *Fucus serratus* on moderately exposed lower eulittoral rock and 20% LS.LSa.MuSa.Lan *Lanice conchilega* in littoral sand along the mid – lower shore. Patches of LR.LLR.FVS.FspiVS *Fucus spiralis* on sheltered variable salinity upper eulittoral rock and LS.LSa.MuSa.Lan *Lanice conchilega* in littoral sand were observed to the north west of the survey area. A list of all biotopes found within the survey area can be found within Appendix A. Similarly, a summary list of the Target Notes taken can be found within Appendix B.

Sediments processed within the survey area were dominated by cobbles, pebbles, and coarse sand. Most of the survey area was reflective in terms of wave energy with cobbles and pebbles dressing the surface of the beach. At the lower shore where the angle of slope decreased, and wave energy was more dissipative, narrow strips and patches of coarse sand ~ 5-10cm deep lay over cobbles and pebbles.

Other notable observations from outside the survey area include a diffuse groundwater seepage zone at NS 19865 60351 and Noddsdale Water discharged fresh water into the bay at NS 19874 60423 approximately 150m metres north of the survey area.

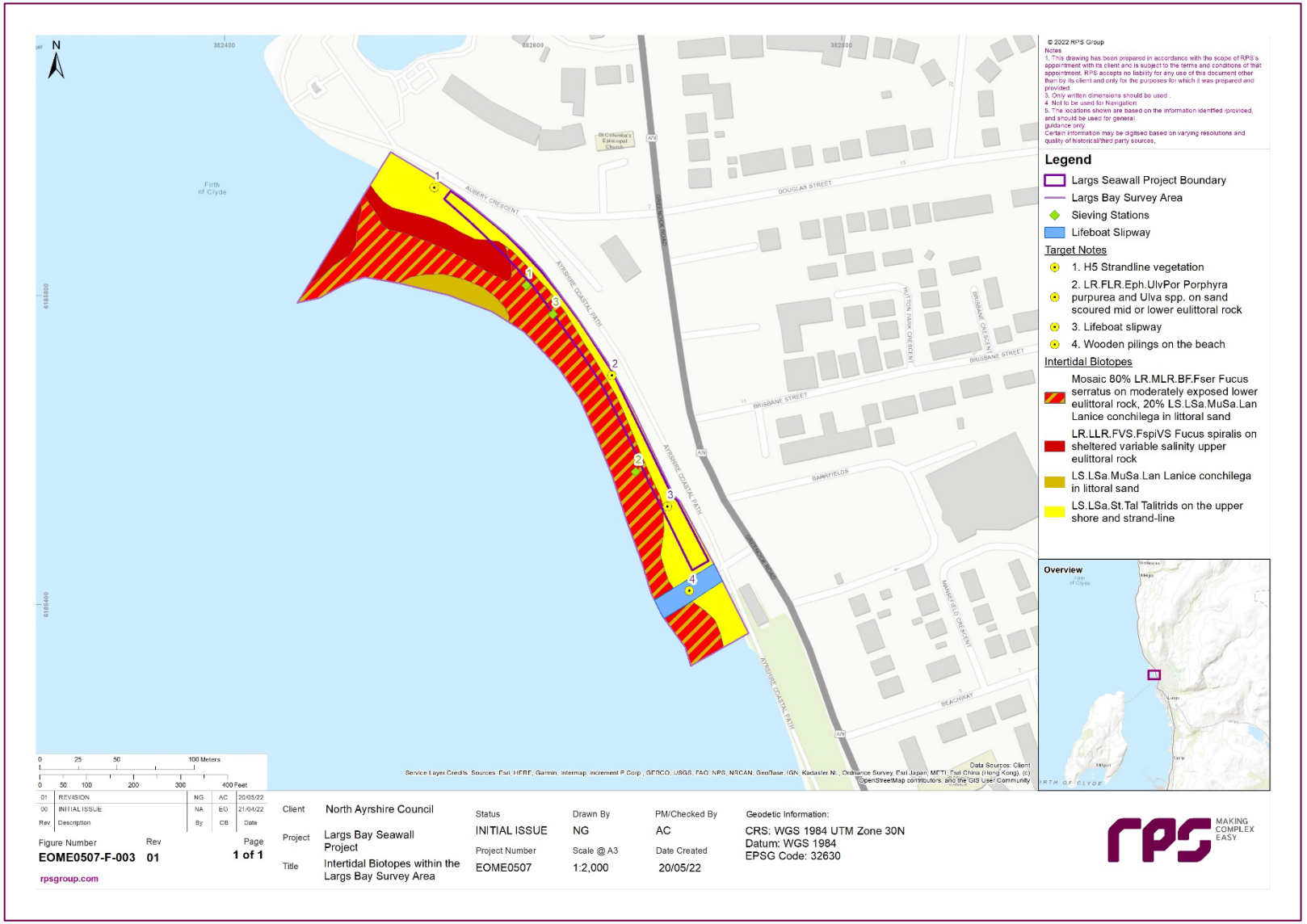


Figure 3.1: Intertidal biotope map of Largs Bay.

3.2 Biotopes

The biotope ***LS.LSa.St.Tal Talitrids on the upper shore and strand-line*** was present at the top of the beach where a super-abundance of sandhoppers (talitrid amphipods) occurred under decomposing seaweed in the north of the site (Figure 3.1). This habitat occurred in a poorer form under the seawall where the density of talitrids was very low due to the absence of a strandline and associated decomposing material.

A limited strand-line of vascular plant flora was also present in the north of the site consisting of sea radish *Raphanus maritimus*, sea mayweed *Tripleurospermum maritimum,* and seedlings of an *Orache* species (Target Note 1). The habitat coding for this vegetation is ***H5 Strandline Vegetation*** (JNCC, 2003; Figure 3.2).

Figure 3.2: *LS.LSa.St.Tal Talitrids on the upper shore and strand-line* and *H5 Strandline Vegetation*

The green seaweed *Ulva intestinalis* was abundant along the lower seawall with the brown seaweed *Fucus spiralis* largely confined on a narrow horizontal shelf. The barnacle *Semibalanus balanoides* occurred occasionally. The biotope ***LR.FLR.Eph.UlvPor Porphyra purpurea and Ulva spp. on sand-scoured mid or lower eulittoral rock*** was also present in places along the seawall shelf (target note 2). *Ulva intestinalis*, was abundant within this biotope while the red seaweed *Porphyra purpurea* and barnacle *Semibalanus balanoides* occurred occasionally (Figure 3.3).

Figure 3.3: The biotope *LR.FLR.Eph.UlvPor Porphyra purpurea and Ulva spp. on sand-scoured mid or lower eulittoral rock* present on the seawall

The biotope **LR.LLR.FVS.FspiVS *Fucus spiralis* on sheltered variable salinity upper eulittoral rock** was present in the north of the survey area (Figure 3.1). *F. spiralis* was the dominant seaweed with *Fucus vesiculosus*, *F. serratus* and *Fucus ceranoides* also present (Figure 3.4). The latter indicates low/variable salinity and was more abundant in the north of the site near sources of fresh water. *S. balanoides* was the predominant barnacle species occurring frequently and covering around 25% of the beach stones. The barnacles *Austrominius modestus* and *Balanus crenatus* occurred occasionally in the north of the site. The tube-forming polychaete worm *Spirobranchus lamarcki* occurred frequently from the mid to lower shore while *Spirorbis spirorbis* was present on a small number of *F. vesiculosus* fronds. The gastropods *Littorina littorea* and *Littorina saxatilis* also occurred occasionally while *Littorina mariae* was rare. The limpet *Patella vulgata* and red seaweeds *Polysiphonia sp*. and *Chondrus crispus* occurred rarely. The substrate was predominately cobbles (40%) with pebbles (20%) gravel (20%) and coarse sand (10%) also present. Beneath the surface large interstitial spaces between cobbles and pebbles were filled with coarse sand. Natural boulders (3%) were rare while large pieces of fallen seawall covered around 7% of the beach surface.

F. serratus is the dominant species in the middle of the survey area. It was present on mixed sized rocks as in the *F. spiralis* zone and contains the similar faunal assemblage only varying in the abundance of *B. crenatus* which was approaching co-dominance with *S. balanoides*. *C. crispus* was more abundant and joined by another two species of red seaweeds *Dumontia contorta* and *Corallina officinalis* which occurred rarely. *Mytilus edulis* was rare and sponges and ascidians were either absent or very sparce. The best fit for this assemblage is ***LR.MLR.BF.Fser Fucus serratus on moderately exposed lower eulittoral rock***.

There was progressively more coarse sand present towards the lower shore where ***LR.MLR.BF.Fser*** was restricted to the hard rocks, occurring in a mosaic with a soft sediment biotope ***LS.LSa.MuSa.Lan***, described below.

Figure 3.4: Foreshore showing *LR.LLR.FVS.FspiVS Fucus spiralis on sheltered variable salinity upper eulittoral rock, LSa.MuSa.Lan Lanice conchilega in littoral sand*. Seawall on left and lifeboat slipway in background.

Large slabs (25cm - >100cm across) of broken seawall were scattered across the *F. spiralis* and *F. serratus* zones. Several fish and invertebrate species attained much higher densities underneath these structures than in surrounding mixed sediments. These included *Nucella lapillus*, *Steromphala cineraria*, *Actinia equina*, *Carcinus maenas*, *L. littorea, L. saxatilis*, *Pholis gunnellus* and *Lipophrys pholis* (Figure 3.5).

Figure 3.5: A variety of molluscs including *N. lapillus* and egg cases on the underside of a fallen seawall slab. The anemone *A. equina* is also present in the foreground

Four wooden pilings (Target Note 3) are present on the beach, each one showing a vertical zonation with *U. intestinalis* abundant at the top and *S. balanoides* abundant in the middle section. *F. spiralis* was occasional across both of these zones. Additional species able to colonise weathered fissures, such as *L. littorea* occurred in the middle zone (Figure 3.6). The wood-boring amphipod *Limnoria lignorum* was present at the base of the pilings causing visible deterioration of the structure (Figure 3.7). A small section of wood was removed during the survey exposing animals in their tunnels in order to confirm presence.

Figure 3.6: Wooden piling showing vertical zonation of species

Figure 3.7: Wooden piles narrow at the base due to boring activity by *Limnoria lignorum.*

The surface of the lifeboat slipway (Target Note 4) is generally free of colonising animals and seaweeds though *S. balanoides* was present on the vertical sides and became superabundant towards the lower shore together with its predator, the commonly occurring *N. lapillus*. Species occurring occasionally on the main wall included *F. spiralis and P. vulgata. A. equina* and *M. edulis* were occasional and rare respectively in recesses between adjoining concrete blocks.

Small patches and strips of coarse sand (less than 5-10cm deep) were present at the low tide mark. Digging and sieving was undertaken at three stations in this habitat (Table 3.1 & Figure 3.8) and an anoxic layer was not encountered. Occasionally, *Arenicola marina* (Figure 3.9) and *Lanice conchilega* (Figure 3.10) were present but in low densities with a slightly greater abundance of the latter. A single live specimen of *Chamelea gallina* was located on the surface of the sand. This biotope was classified as a poor form of ***LS.LSa.MuSa.Lan Lanice conchilega in littoral sand***.

Table 3.1: Sieving stations, their physical characteristics and fauna.

Station	NGR	Sediments	Fauna	Notes
S1	NS 20021 60237	Coarse red sand to 5-10 cm, pebbles and cobbles underneath. No anoxic layer	*C. maenas* – juvenile *L. conchilega* x 4	
S2	NS 20090 60115	Coarse red sand to 5-10 cm, pebbles and cobbles underneath. No anoxic layer	None	*A. marina* *L. conchilega* nearby
S3	NS 20038 60218	Coarse red sand to 5-10 cm, pebbles and cobbles underneath. No anoxic layer	*C. maenas* – juvenile *C. gallina* (on surface)	*A. marina* *L. conchilega* nearby

Figure 3.8: Example station from sieving station 1 showing gravel and coarse sand content

Figure 3.9: ***Arenicola marina*** **in** ***LSa.MuSa.Lan Lanice conchilega in littoral sand***

Figure 3.10: *Lanice conchilega* in *LSa.MuSa.Lan Lanice conchilega in littoral sand*

3.3 Observations in wider area

Brief observations were made on biotopes surrounding the formal survey area in order to obtain an understanding of biotope continuity across the wider context of the beach. These areas were not mapped and species present were not listed in detail.

The intertidal zone widens significantly immediately north of the formal survey area up to the Noddsdale Water. ***LLR.FVS.FspiVS Fucus spiralis on sheltered variable salinity upper eulittoral rock*** becomes the dominant biotope in this area, within which *F. ceranoides* is sometimes dominant in patches and around seams reflecting freshwater seepage and run-off. *U intestinalis* and *Ulva lactuca* were also observed albeit in low densities in this habitat.

The habitats in the south continue outside of the formal survey area in a similar fashion for approximately 100m.

LS.LSa.MuSa.Lan Lanice conchilega in littoral sand on the intertidal extends into the infralittoral zone and a live sea potato, *Echinocardium cordatum* was observed in this biotope. Further out in the infralittoral a band of *Laminaria saccharina* with associated red seaweeds occurred sparsely where cobbles were exposed or lay just beneath the surface of the sand.

4 HABITATS OF CONSERVATION IMPORTANCE

This section identifies the biotopes of conservation importance as described by the Annex I Habitats Directive.

4.1 Intertidal Sand and Mudflats

The following biotopes are part of the Annex I Habitats Directive habitat – *1140 Mudflats and sandflats not covered by seawater at low tide*:

- ***LS.Lsa.St.Tal Talitrids on the upper shore and strand-line***
- ***LS.LSa.MuSa.Lan, Lanice conchilega in littoral sand***

4.2 Other Biotopes

All other biotopes within the study area are UK Broad Biodiversity Action Plan habitats.

5 SUMMARY

The narrow nature of the intertidal zone means that several biotopes appear spatially compressed and restricted to a transitional state, lacking the space to develop fully into characteristic assemblages. However, two of the biotopes on site qualify as habitats protected under Annex I of the Habitats Directive and all of the biotopes present are UK Broad Biodiversity Action Plan habitats.

6 REFERENCES

Davies, J., Baxter, J., Bradley, M., Connor, D., Khan, J., Murray, E., Sanderson, W., Turnbull, C. & Vincent, M. (2001). *Marine Monitoring Handbook*. JNCC, Peterborough.

JNCC (2003). *Handbook for Phase 1 habitat survey - a technique for environmental audit.* JNCC, Peterborough.

JNCC (2015). *The Marine Habitat Classification for Britain and Ireland Version 22.04. [Accessed 17.04.2022]* Available at: https://mhc.jncc.gov.uk/

Wentworth, C. K. (1922). A Scale of Grade and Class Terms for Clastic Sediments. *The Journal of Geology*. 30 (5): 377–392

Wyn, G. and Brazier, P. (2001). *Procedural Guideline No. 3-1 - In situ intertidal biotope recording*. In Davies J., Baxter J., Bradley M., Connor D., Khan J., Murray E., Sanderson W., Turnbull C. & Vincent M. (2001). *Marine Monitoring Handbook*. JNCC, Peterborough.

Wyn, G., Brazier, P., Birch, K., Bunker, A., Cooke, A., Jones, M., Lough, N., McMath, A. & Roberts, S. (2006). *Handbook for Marine Intertidal Phase 1 Biotope Mapping Survey*. Countryside Council for Wales, Bangor.

Appendix A

List of Biotopes in the Survey Area

Shore Position	Biotope/Phase 1 Code	Biotope Name	Biotope Description
Upper Shore	LS.LSa.St.Tal	Talitrids on the upper shore and strand-line	A community of sandhoppers (talitrid amphipods) may occur on any shore where driftlines of decomposing seaweed and other debris accumulate on the strandline. The biotope occurs most frequently on medium and fine sandy shores, but may also occur on a wide variety of sediment shores composed of muddy sediment, shingle and mixed substrata, or on rocky shores.
Upper Shore	H5	Strandline Vegetation	Open community of the driftline on shingle or rock. The stand of vegetation on site was not distinct enough for NVC classification.
Upper Shore	LR.FLR.Eph.UlvPor	*P. purpurea* and *Ulva* spp. on sand-scoured mid or lower eulittoral rock	Exposed and moderately exposed mid-shore bedrock and boulders occurring adjacent to areas of sand which significantly affects the rock. Under the blanket of ephemeral seaweeds, the barnacles *S. balanoides* or *A. modestus* and the limpet *P. vulgata* may occur in the less scoured areas, along with the occasional winkles *L. littorea* and *L. saxatilis*. Few other species are present.
Upper & mid shore	LR.LLR.FVS.FspiVS	*Fucus spiralis* on sheltered variable salinity upper eulittoral rock	Sheltered to extremely sheltered upper eulittoral bedrock or mixed substrata (boulders, large cobbles or shells on mud) in variable salinity conditions characterised by a band of the spiral wrack *F. spiralis*. The barnacles *S. balanoides* and *A. modestus* can be found where suitable substrata are available, while gammarids can be found underneath the fronds of *F. spiralis* and/or underneath the boulders and cobbles. Also found underneath the fronds and among the boulders are the winkles *L. saxatilis* and *L. littorea* and the crab *C. maenas*.
	LR.MLR.BF.Fser	*Fucus serratus* on moderately exposed lower eulittoral rock	Lower eulittoral bedrock and stable boulders on moderately exposed to sheltered shores with a canopy of the wrack *F. serratus* and an associated fauna consisting of the limpet *P. vulgata*, the barnacle *S. balanoides*, the whelk *N. lapillus*, the anemone *A. equina* and the sponge *Halichondria panicea*.
Lower shore	LS.LSa.MuSa.Lan	*Lanice conchilega* in littoral sand	Can occur on the lower part of predominantly rocky or boulder shores, where patches of sand or muddy sand occur between scattered boulders, cobbles and pebbles. Conditions may be tide-swept, and the sediment may be mobile, but the biotope usually occurs in areas sheltered from strong wave action. The sediment supports dense populations of the sand mason *Lanice conchilega*.

Appendix B

Target Notes

Number	Target Note	NGR
1	H5 Strandline vegetation	NS 19962 60301
2	LR.FLR.Eph.UlvPor *Porphyra purpurea* and *Ulva* spp. on sand scoured mid or lower eulittoral rock	NS 20076 60178
3	Wooden pilings on the beach	NS 20110 60092
4	Lifeboat slipway	NS 20124 60038