

NPWS

Lady's Island Lake SAC
(site code: 000704)

**Conservation objectives supporting document-
Coastal habitats**

Version 1

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Please note that the opinions expressed in the site report from the Vegetated Shingle Monitoring Project (VSM) are those of the authors and do not necessarily reflect the opinion or policy of NPWS.

Please note that this document should be read in conjunction with the following report: NPWS (2019) Conservation Objectives: Lady’s Island Lake SAC 000704. Version 1.0. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht.

1 Introduction

Achieving Favourable Conservation Status (FCS) is the overall objective to be reached for all Annex I habitat types and Annex II species of European Community interest listed in the Habitats Directive 92/43/EEC (European Communities, 2013). It is defined in positive terms such that a habitat type or species must be prospering and have good prospects of continuing to do so.

Lady's Island Lake SAC is a medium sized Special Area of Conservation (SAC) located approximately 10km south of Rosslare, Co. Wexford. The SAC contains a shallow, brackish coastal lagoon separated from the sea by a sand and shingle barrier. The lagoon barrier system, which stretches along the entire seaward part of the SAC from Carnsore Point westwards towards Tacumshin, comprises the best example in Ireland of a landward moving (transgressive) system of gravel-based barrier. The sequence of back barrier washover and seepage structures are among the best in Europe. The SAC also includes a small area of intertidal reef to the west of Carnsore Point.

Of particular note within the dune habitats present in the SAC is the occurrence of cottonweed (*Achillea maritima*, formerly *Otanthus maritimus*), a *Critically Endangered* plant (Wyse Jackson *et al.*, 2016) which has its main remaining Irish population in Lady's Island Lake SAC. Cottonweed is also legally protected through its listing on the Flora (Protection) Order, 2015 (FPO; Statutory Instrument No. 356 of 2015). In addition to cottonweed, three other Red Listed (Wyse Jackson *et al.*, 2016) species occur within the SAC: the FPO listed and *Endangered* pennyroyal (*Mentha pulegium*), the FPO listed and *Near Threatened* lesser centaury (*Centaureum pulchellum*) and the *Near Threatened* golden dock (*Rumex maritimus*).

Lady's Island Lake SAC (site code: 000704) is selected for coastal lagoons (a priority habitat), reefs and perennial vegetation of stony banks. The following coastal habitat is included in the list of Qualifying Interests for the SAC and is dealt with in this supporting document:

1220 Perennial vegetation of stony banks

The mapped distribution of perennial vegetation of stony banks in Lady's Island Lake SAC is presented in Appendix I.

2 Conservation Objectives

A conservation objective aims to define the favourable conservation condition of a habitat or species at a particular site. Implementation of the objective will help to ensure that the habitat or species achieves favourable conservation status at a national level.

This supporting document sets out the conservation objective for perennial vegetation of stony banks in Lady's Island Lake SAC, which is defined by a list of parameters, attributes and targets. The main parameters are (a) Range (b) Area and (c) Structure and Functions, the last of which is broken down into a number of attributes, including physical structure, vegetation structure and vegetation composition.

The targets set for perennial vegetation of stony banks (vegetated shingle) are based in part on the findings of the Vegetated Shingle Monitoring Project (VSM) (Martin *et al.*, 2017), which was carried out in 2016 on behalf of the National Parks and Wildlife Service (NPWS). This document should be read in conjunction with that report.

Vegetated shingle within Lady's Island Lake SAC was also recorded during the National Shingle Beach Survey (NSBS), which was carried out in 1999 on behalf of NPWS (Moore and Wilson, 1999), and during the Coastal Monitoring Project (CMP) which ran from 2004 to 2006, also on behalf of NPWS (Ryle *et al.*, 2009).

The VSM surveyed, mapped and assessed a single sub-site associated with Lady's Island Lake SAC (Martin *et al.*, 2017):

Lady's Island Lake (VSM site code 024)

As part of the VSM, a detailed individual site report and habitat maps were produced for the Lady's Island Lake sub-site and these are included in Appendix II at the end of this document. As well as perennial vegetation of stony banks, the VSM also surveyed other Annex I habitats in the SAC, i.e. annual vegetation of drift lines, shifting dunes along the shoreline with *Ammophila arenaria* (white dunes), embryonic shifting dunes, fixed coastal dunes with herbaceous vegetation (grey dunes) and humid dune slacks. However, these sand dune habitats are not Qualifying Interests for the SAC.

The conservation objective for perennial vegetation of stony banks in Lady's Island Lake SAC is based on the findings of the VSM (Martin *et al.*, 2017).

3 Perennial vegetation of stony banks

The following definition of perennial vegetation of stony banks habitat in Ireland is based on the data collected during the VSM (Martin *et al.*, 2017) and is an adaptation of the definitions used in European Commission (2013) and NPWS (2013).

Perennial vegetation of stony banks occurs along the coast where shingle (cobbles, pebbles, and gravel $\geq 2\text{mm}$) has accumulated to form elevated ridges or banks above the high tide mark. The majority of the rocky material should be between 2mm and 256mm in diameter to be considered in this habitat category. On the upper beach, the pioneer community can be characterised by perennial species such as sea beet (*Beta vulgaris* subsp. *maritima*), sea-kale (*Crambe maritima*), rock samphire (*Crithmum maritimum*), cleavers (*Galium aparine*), yellow-horned poppy (*Glaucium flavum*), sea pea (*Lathyrus japonicus*), wild radish (*Raphanus raphanistrum* subsp. *maritimus*), curled dock (*Rumex crispus*), sea campion (*Silene uniflora*), perennial sow-thistle (*Sonchus arvensis*) and sea mayweed (*Tripleurospermum maritimum*). The majority of the area within this pioneer community is usually bare shingle. At the top of the beach, and moving inland, a wider range of vegetation types can be found at larger shingle sites including a lichen-rich community and coastal forms of grassland, heath and scrub. The grassland community can be characterised by grass species such as common bent-grass (*Agrostis capillaris*), creeping bent-grass (*A. stolonifera*), false oat-grass (*Arrhenatherum elatius*), cock's-foot (*Dactylis glomerata*), spreading meadow-grass (*Poa humilis*), sand couch (*Elytrigia repens*), red fescue (*Festuca rubra*), Yorkshire fog (*Holcus lanatus*) and crested hair-grass

(*Koeleria macrantha*), field wood-rush (*Luzula campestris*), and broadleaf herbs such as yarrow (*Achillea millefolium*), thrift (*Armeria maritima*), common mouse-ear (*Cerastium fontanum*), wild carrot (*Daucus carota*), autumn hawkbit (*Leontodon autumnalis*), common bird's-foot trefoil (*Lotus corniculatus*), buck's-horn plantain (*Plantago coronopus*), ribwort plantain (*P. lanceolata*), silverweed (*Potentilla anserina*), common sorrel (*Rumex acetosa*), dandelion (*Taraxacum officinale* agg.), lady's bedstraw (*Galium verum*), red clover (*Trifolium pratense*) and white clover (*T. repens*). The scrub community can be characterised by the woody species honeysuckle (*Lonicera periclymenum*), blackthorn (*Prunus spinosa*), bramble (*Rubus fruticosus* agg.), gorse (*Ulex europaeus*) and the climber hedge bindweed (*Calystegia sepium*). These more inland communities have less bare shingle and vegetative cover usually dominates. The majority of the grassland and scrub communities are rooted within soil, whereas the pioneer community is usually rooted in gravel, sand or organic matter (e.g. decomposing seaweed and other plant material). Once the soil layer on top of the shingle is more than 30cm deep, the community is no longer defined as perennial vegetation of stony banks.

3.1 Overall Objective

The overall objective for 'Perennial vegetation of stony banks' in Lady's Island Lake SAC is to 'restore the favourable conservation condition'.

This objective is based on an assessment of the recorded condition of the habitat under a range of attributes and targets. The assessment is divided into three main headings: (a) Range, (b) Area and (c) Structure and Functions.

3.2 Area

3.2.1 Habitat area

Habitat extent is a basic attribute to be assessed when determining the condition of a particular habitat. The target for favourable condition is that there is no decrease from the established baseline. Bearing in mind that coastal systems are naturally dynamic and subject to change, even within a season, this target is assessed subject to natural processes, including erosion and succession.

The VSM (Martin *et al.*, 2017) mapped the area of vegetated shingle where it occurred. The area of perennial vegetation of stony banks recorded by the VSM in the Lady's Island Lake sub-site was 1.25ha, of which 0.97ha lies within the boundary of Lady's Island Lake SAC.

The area of perennial vegetation of stony banks had decreased from 1.42ha during the CMP (Ryle *et al.*, 2009) to 1.25ha during the VSM (Martin *et al.*, 2017) in the sub-site due to succession to embryonic shifting dunes habitat, natural erosion and anthropogenic activities (shingle extraction). Perennial vegetation of stony banks also increased in area in some locations, particularly due to the development of the habitat after extreme storm events; however, these increases were not enough to offset the losses (Martin *et al.*, 2017).

The target is that the habitat area should be stable or increasing, subject to natural processes, including erosion and succession.

3.3 Range

3.3.1 Habitat distribution

The recorded location of the surveyed vegetated shingle site in Lady's Island Lake SAC, as mapped by Martin *et al.* (2017), is presented in Appendix I.

Perennial vegetation of stony banks is located south of Lady's Island Lake and west of Carnsore Point in the SAC (Martin *et al.*, 2017).

The NSBS (Moore and Wilson, 1999) classified the perennial vegetation of stony banks in the NSBS site Lady's Island Lake Barrier as a vegetated lagoonal system and it is defined as a bar and as a fringing beach following Chapman (1976).

The NSBS (Moore and Wilson, 1999) ranked each surveyed site as either High, Medium or Low interest, based on site representativity, species diversity, habitat diversity and the presence of rare or scarce species. The Lady's Island Lake Barrier site was ranked as a 'High interest' site by the NSBS, denoting a site that is of high conservation value and perhaps of interest botanically or geomorphologically (Moore and Wilson, 1999).

The target is that there should be no decline or change in the distribution of the habitat, unless it is the result of natural processes, including erosion and succession.

3.4 Structure and Functions

A fundamental aim of shingle conservation is to facilitate natural mobility. Shingle beaches are naturally dynamic systems, making them of geomorphological interest, as well as ecological interest. They are constantly changing and shingle features are rarely stable in the long-term.

3.4.1 Physical structure: functionality and sediment supply

The health and on-going development of the habitat relies on a continuing supply of shingle sediment. This may occur sporadically as a response to storm events rather than continuously. Interference with the natural coastal processes, through offshore (or onshore) extraction or coastal defence structures in particular, can interrupt the supply of sediment and lead to beach starvation.

The shingle in the Lady's Island Lake sub-site comprises pebble and gravel as defined using a modified version of the particle size ranges defined in Fossitt (2000). Gravel was recorded as the major component in all monitoring stops in the Lady's Island Lake sub-site (Martin *et al.*, 2017).

Table 1. Shingle composition (as defined in Fossitt (2000) with minor modifications) of perennial vegetation of stony banks in the Lady's Island Lake sub-site during the VSM 2016. Percentage (%) cover shown, recorded to the nearest 5%. Only stops with exposed shingle could contribute to the data presented.

	Stop 1	Stop 2	Stop 3	Stop 4
Boulder (>256 mm)	0	0	0	0
Cobble (>64-256 mm)	0	0	0	0
Pebble (>16-64 mm)	5	0	5	45
Gravel (2-16 mm)	95	100	95	55

Shingle extraction was recorded in the habitat in the Lady's Island Lake sub-site during the VSM (Martin *et al.*, 2017). Removal of beach material had also been noted as an impact on the habitat by the NSBS (Moore and Wilson, 1999).

The target is to maintain, or where necessary restore, the natural circulation of sediment and organic matter, without any physical obstructions.

3.4.2 Physical structure: disturbance

Damage to the habitat due to disturbance was assessed as a negative indicator by Martin *et al.* (2017). Disturbance can include damage from heavy trampling, vehicle damage and removal of substrate.

The target is that no more than 20% of the habitat is affected by disturbance.

3.4.3 Vegetation structure: zonation

Ecological variation within this habitat type depends on stability, the amount of fine material accumulating between the pebbles, climatic conditions, width of the foreshore and past management of the site. The ridges and lows also influence the vegetation patterns, resulting in characteristic communities and zonations of bare and vegetated shingle. In the frontal, less stable areas of shingle, the vegetation tends to be dominated by short-lived salt-tolerant perennials (pioneer community). Where the shingle is more stable, it becomes more vegetated and may include grassland, heathland and scrub communities, depending on the exact nature of the site. The presence of lichens indicates long-term stability of the shingle structure. Further information on the communities of perennial vegetation of stony banks is found in Martin *et al.* (2017).

The VSM (Martin *et al.*, 2017) recorded two communities of perennial vegetation of stony banks in the Lady's Island Lake sub-site - a pioneer community and a grassland community; however, the more stable grassland community was only recorded outside the boundary of the SAC. The most abundant community and the only one recorded within the SAC boundary was the pioneer community, found towards the front of the system.

Vegetated shingle is part of a naturally dynamic coastal system. In order to ensure the ecological functioning of all of the vegetated shingle communities present, it is vital to maintain the zonations and transitions to other habitats, including lagoon, saltmarsh and sand dune habitats.

Habitats that are associated with the vegetated shingle in Lady's Island Lake SAC include sand dune habitats and a lagoon.

The target is to maintain the range of coastal habitats, including transitional zones, subject to natural processes, including erosion and succession.

3.4.4 Vegetation composition: typical species and sub-communities

The degree of exposure, as well as the coarseness and stability of the substrate determines species diversity. Typical species lists for the three main vegetated shingle communities (pioneer, grassland and scrub) are presented in Martin *et al.* (2017).

The vegetated shingle in the Lady’s Island Lake sub-site includes two communities of perennial vegetation of stony banks that were recorded during the VSM (Martin *et al.*, 2017) – a pioneer and a grassland community. However, as mentioned above, only the pioneer community was recorded within the boundary of the SAC. Table 2 presents the typical species recorded within the pioneer community of perennial vegetation of stony banks at Lady’s Island Lake. No monitoring stop was recorded within the small grassland community (which occurs outside the SAC boundary), but species of note were abundant red fescue (*Festuca rubra*), and occasional lyme-grass (*Leymus arenarius*) and sea beet (*Beta vulgaris* subsp. *maritima*) (Martin *et al.*, 2017).

Table 2. Typical species recorded within the pioneer community of perennial vegetation of stony banks in the Lady’s Island Lake sub-site. Negative and non-native species are excluded from the list.

Pioneer community	
<i>Anagallis arvensis</i>	<i>Eryngium maritimum</i>
<i>Anthyllis vulneraria</i>	<i>Euphorbia paralias</i>
<i>Atriplex laciniata</i>	<i>Festuca rubra</i>
<i>Atriplex prostrata</i>	<i>Glaucium flavum</i>
<i>Beta vulgaris</i> subsp. <i>maritima</i>	<i>Honckenya peploides</i>
<i>Cakile maritima</i>	<i>Hypochaeris radicata</i>
<i>Calystegia soldanella</i>	<i>Lotus corniculatus</i>
<i>Carex arenaria</i>	<i>Plantago coronopus</i>
<i>Catapodium rigidum</i>	<i>Polygonum oxyspermum</i> subsp. <i>raii</i>
<i>Cochlearia officinalis</i>	<i>Rumex crispus</i>
<i>Crepis capillaris</i>	<i>Senecio vulgaris</i>
<i>Crithmum maritimum</i>	<i>Sonchus</i> species
<i>Elytrigia juncea</i>	<i>Tripleurospermum maritimum</i>
<i>Erodium maritimum</i>	

Notable species were also recorded during the VSM (Martin *et al.*, 2017). The *Near Threatened* species yellow-horned poppy (*Glaucium flavum*) (Wyse Jackson *et al.*, 2016) was recorded within the perennial vegetation of stony banks habitat during the VSM (Martin *et al.*, 2017), as it had been by the CMP (Ryle *et al.*, 2009).

The target for this attribute is to ensure that occurrence of the typical species within the range of vegetated shingle communities is maintained.

3.4.5 Vegetation composition: negative indicator species

Negative indicator species can include species indicative of changes in nutrient status, e.g. nettle (*Urtica dioica*), and species not considered to be typical of the habitat, e.g. bracken (*Pteridium aquilinum*). The list of negative indicator species commonly found in the habitat is presented in Appendix I of Martin *et al.* (2017).

The negative indicator species common ragwort (*Senecio jacobaea*) was recorded within one monitoring stop in the Lady's Island Lake sub-site during the VSM, but at less than 1% cover (Martin *et al.*, 2017).

The target for negative indicator species is that no species is present in more than 60% of stops and the combined cover in any individual stop is 25% or less.

3.4.6 Vegetation composition: non-native species

Non-native species can be invasive and have deleterious effects on native vegetation. Low targets are set as non-native species can spread rapidly and are most easily dealt with when still at lower abundances.

The VSM (Martin *et al.*, 2017) did not record any non-native species within the shingle habitat in the Lady's Island Lake sub-site. However, sea-buckthorn (*Hippophae rhamnoides*) was recorded in the fixed dune habitat surveyed by the VSM in the SAC (Martin *et al.*, 2017). As this non-native invasive species is very aggressive, preventing the invasion of vegetated shingle in Lady's Island Lake SAC by sea-buckthorn will require specific measures.

The target for non-native species is that no species is present in more than 20% of stops, the combined cover in any individual stop is 1% or less, and the cover across the whole site 1% or less. At a site level, if a non-native species has been under-recorded, or not recorded, via the stops the percentage cover for the species across the site should be recorded and assessed.

4 References

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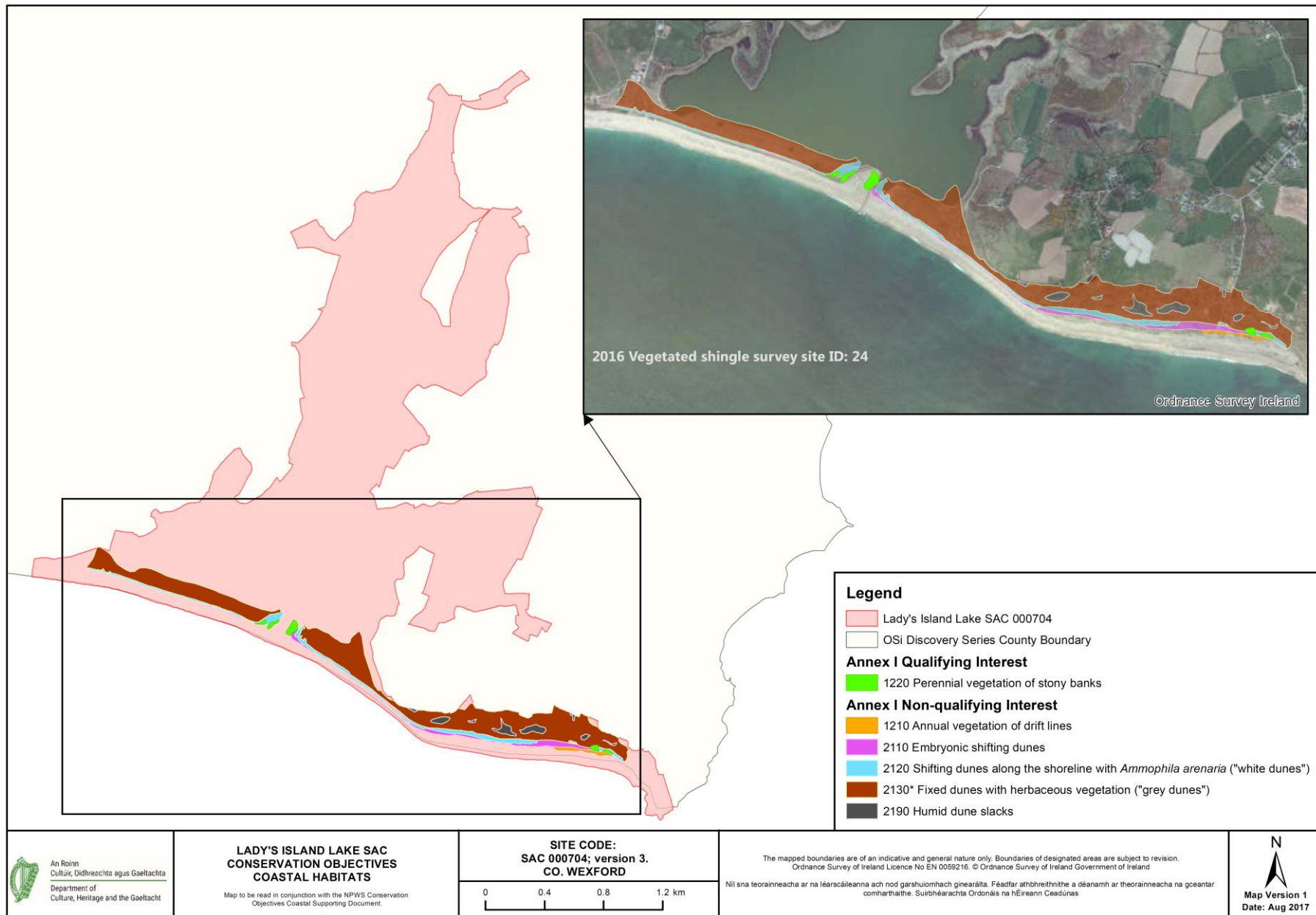
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Appendix I – Distribution map of perennial vegetation of stony banks in Lady’s Island Lake SAC



Appendix II – Lady’s Island Lake site report and habitat maps from the Vegetated Shingle Monitoring Project (VSM)

SITE 024 LADY’S ISLAND LAKE

The following individual site report should be read in conjunction with the main report (Martin *et al.*, 2017). Please note that NSBS refers to the National Shingle Beach Survey (NSBS) (Moore & Wilson, 1999), CMP refers to the baseline Coastal Monitoring Project (Ryle *et al.*, 2009), SDM refers to the Sand Dunes Monitoring Project (Delaney *et al.*, 2013) and VSM to the Vegetated Shingle Monitoring Project (Martin *et al.*, 2017).

The shingle at this location is referred to as Site 131 Lady’s Island Lake barrier by the NSBS, and the dune system and shingle at this location is referred to as Site 39 Carnsore by the CMP.

1 SITE DESCRIPTION

Lady's Island Lake is a medium sized site located approximately 10 km south of Rosslare, Co. Wexford. The site runs south from Carna, around Carnsore Point, and west as far as Rostonstown, forming the southern edge of Lady's Island Lake. Lady's Island Lake is Ireland's best and largest example of a sedimentary lagoon with a sand/shingle barrier (NPWS, 2013). Five Annex I sand dune habitats (* indicates a priority habitat) were recorded during the CMP: **1220 Perennial vegetation of stony banks**, **2110 Embryonic shifting dunes**, **2120 Marram dunes (white dunes)**, ***2130 Fixed dunes (grey dunes)** and **2190 Humid dune slacks**. The main Annex I habitat associated with the sand dunes at Lady's Island Lake includes ***1150 Coastal lagoons**.

The rare Flora Protection Order (FPO) species *Otanthus maritimus* (cottonweed) was recorded in the ***2130 Fixed dunes (grey dunes)** during the CMP and within **2120 Marram dunes (white dunes)** during the VSM. Lady’s Island Lake is the last remaining site for *Otanthus maritimus* in Ireland due to this, the site was ranked as a ‘High interest’ site by the NSBS. Other noteworthy species include the FPO species *Centaurium pulchellum* (lesser centaury) and *Mentha pulegium* (pennyroyal), and the Red Data Book species *Rumex maritimus* (golden dock), however none were recorded on site during the CMP or VSM.

The site is used for recreation, with no evidence of agricultural activities. Due to its exposed nature however, the site does not see high recreational use, with recreation restricted to walking for the most part.

2 CONSERVATION ASSESSMENTS

2.1 Overview

Lady's Island Lake was surveyed between the 1st and 2nd of June 2016. Of the five Annex I habitats recorded on the site during the baseline survey, all were recorded in 2016. Additionally, **1210 Annual vegetation of drift lines** was recorded during the VSM. The habitats found at Lady's Island Lake in 2016 and the results of the conservation assessments are presented in Table 1. The conservation status of **1210 Annual vegetation of drift lines** was assessed as Favourable, **1220 Perennial vegetation of stony banks**, **2110 Embryonic shifting dunes** and **2120 Marram dunes (white dunes)** were assessed

as Unfavourable-Inadequate, while ***2130 Fixed dunes (grey dunes)** and **2190 Humid dune slacks** were assessed as Unfavourable-Bad. **1210 Annual vegetation of drift lines** were not present, and therefore not assessed, during the CMP and therefore no comment on whether the condition of these habitats is improving, deteriorating or remaining stable could be made.

Table 1. Conservation assessment results for all Annex I dune habitats surveyed at Lady’s Island Lake, Co. Wexford.

Habitat	Area	Structure & Functions	Future Prospects	Overall result
1210 Annual vegetation of drift lines	Favourable	Favourable	Favourable	Favourable
1220 Perennial vegetation of stony banks	Unfavourable-Inadequate (deteriorating)	Unfavourable-Inadequate (deteriorating)	Unfavourable-Inadequate (deteriorating)	Unfavourable-Inadequate (deteriorating)
2110 Embryonic shifting dunes	Favourable (stable)	Favourable (stable)	Unfavourable-Inadequate (deteriorating)	Unfavourable-Inadequate (deteriorating)
2120 Marram dunes (white dunes)	Favourable (stable)	Unfavourable-Inadequate (stable)	Unfavourable-Inadequate (stable)	Unfavourable-Inadequate (stable)
*2130 Fixed dunes (grey dunes)	Favourable (stable)	Unfavourable-Bad (stable)	Unfavourable-Bad (stable)	Unfavourable-Bad (stable)
2190 Humid dune slacks	Favourable (improving)	Unfavourable-Inadequate (stable)	Unfavourable-Bad (stable)	Unfavourable-Bad (stable)

The Area and Structure and Functions of **2110 Embryonic shifting dunes** have now remained Favourable across two reporting periods, as determined by the CMP and VSM. It is proposed that if Area and Structure and Functions remain Favourable after the next reporting period all recorded activities should be judged to be having a neutral effect as demonstrated by the consistently favourable Area and Structure and Functions.

2.1.1 Area

The areas of Annex I sand dune habitats at Lady’s Island Lake are presented in Table 2. The baseline habitat areas presented here are taken from the baseline CMP maps for this site (Ryle *et al.*, 2009), with some minor changes made as a result of re-interpretation of some sand dune habitats during the VSM. Comparisons are made between the baseline CMP areas and the VSM areas, as presented in Table 2, for changes in habitat area at this site.

Table 2. Areas of Annex I dune habitats mapped at Lady’s Island Lake during the baseline CMP survey and the VSM.

Habitat	*Baseline CMP (ha)	VSM (ha)
1210 Annual vegetation of drift lines	0.00	0.64
1220 Perennial vegetation of stony banks	1.42	1.25
2110 Embryonic shifting dunes	4.13	3.55
2120 Marram dunes (white dunes)	2.69	5.52
*2130 Fixed dunes (grey dunes)	46.61	47.55
2190 Humid dune slacks	2.40	2.40
Total	57.25	60.91

*Note: Baseline CMP areas were revised based on re-interpretation of some habitats during the VSM survey.

1210 Annual vegetation of drift lines was not found during the CMP but has since developed in two areas due to natural processes. **1220 Perennial vegetation of stony banks** and **2110 Embryonic shifting dunes** have both decreased in area since the CMP. The majority of this loss can be attributed to succession to other habitats, however **1220 Perennial vegetation of stony banks** suffered from some anthropogenic loss too due to shingle extraction. The area lost was approximately 225 m², which is equivalent to less than 1% per year since the CMP. Both habitats also saw new areas of development since the CMP, but not enough to outweigh the loss in area. **2120 Marram dunes (white dunes)** and ***2130 Fixed dunes (grey dunes)** both increased in area since the CMP. These changes in area can be attributed to natural processes, namely succession and deposition. **2190 Humid dune slacks** had no change in area since the CMP.

With regards to interpretation, all habitats mapped during the CMP had minor adjustments made to their areas. **1220 Perennial vegetation of stony banks**, **2120 Marram dunes (white dunes)** and ***2130 Fixed dunes (grey dunes)** had additional areas outside of the original CMP site boundary for Lady's Island Lake and were summarily added to the site, with the CMP areas adjusted accordingly. In addition to this, the boundary between ***2130 Fixed dunes (grey dunes)** and **2190 Humid dune slacks** was adjusted due to interpretation by the VSM surveyors. Their CMP areas were adjusted accordingly to reflect this change in the habitat boundaries. Small areas mapped as ***2130 Fixed dunes (grey dunes)** during the CMP were determined by the VSM surveyors to be **1220 Perennial vegetation of stony banks**, **2110 Embryonic shifting dunes** and wet grassland instead, while an area of scrub was determined to be ***2130 Fixed dunes (grey dunes)**. The CMP area of ***2130 Fixed dunes (grey dunes)** was revised according to these changes.

The total area of sand dune habitats has increased from 57.25 ha to 60.91 ha since the baseline CMP survey due to natural processes of deposition resulting in the formation of new foredune habitats. This deposition occurred on the southern coastline from Lady's Island Lake to Carnsore Point. Area for **1220 Perennial vegetation of stony banks** was assessed as Unfavourable-Inadequate due to anthropogenic induced loss of habitat. As all changes in area for the other habitats are due to either interpretation or natural processes, Area for the other sand dune habitats was Favourable.

2.1.2 Structure and Functions

Table 3 shows the number of monitoring stops carried out in each habitat and the number of criteria assessed. The number of criteria that failed is also shown. The Structure and Functions of **1210 Annual vegetation of drift lines** and **2110 Embryonic shifting dunes** were assessed as Favourable. **1220 Perennial vegetation of stony banks**, **2120 Marram dunes (white dunes)** and **2190 Humid dune slacks** were assessed as Unfavourable-Inadequate, while ***2130 Fixed dunes (grey dunes)** was assessed as Unfavourable-Bad due to the failure of five criteria.

Table 3. Annex I sand dune habitats at Lady’s Island Lake for which Structure and Functions were assessed, with the number of monitoring stops, assessment criteria and the number of criteria that failed.

Habitat	No. monitoring stops	Total no. assessment criteria	No. failed criteria
1210 Annual vegetation of drift lines	4	6	0
1220 Perennial vegetation of stony banks	4	7	2
2110 Embryonic shifting dunes	8	7	0
2120 Marram dunes (white dunes)	8	7	2
*2130 Fixed dunes (grey dunes)	12	11	5
2190 Humid dune slacks	8	11	2

2.1.3 Future Prospects

Impacts and activities recorded at Lady’s Island Lake are presented in Table 4. Impact codes are assigned according to Ssymank (2011). No impacts were recorded for **1210 Annual vegetation of drift lines**. Walking was recorded as a negative impact for **2110 Embryonic shifting dunes**, **2120 Marram dunes (white dunes)**, ***2130 Fixed dunes (grey dunes)** and **2190 Humid dune slacks**, while vehicle tracks were also recorded in these habitats, excluding **2110 Embryonic shifting dunes**. Shingle extraction and the presence of rock armour were recorded as negative impacts for **1220 Perennial vegetation of stony banks**, while storm activity was recorded as a positive impact for this habitat, as it has created new habitat for colonisation. Maintenance of a large cut between the lagoon and sea was recorded as a negative impact for both **2120 Marram dunes (white dunes)** and ***2130 Fixed dunes (grey dunes)**. Other negative impacts included a lack of grazing, paths and tracks, invasive non-native species (*Hippophae rhamnoides*) and scrub encroachment for ***2130 Fixed dunes (grey dunes)**, and signs of eutrophication, trampling and drainage for **2190 Humid dune slacks**.

Table 4. Impacts recorded in Annex I sand dune habitats at Lady’s Island Lake in 2016. Source refers to whether the impact being scored originates inside or outside the Annex I habitat being assessed.

Habitat code	Impact code	Impact description	Intensity	Effect	Percent of habitat	Source
1220	C01.01.02	Shingle extraction	High	Negative	2	Inside
1220	J02.12.01	Rock armour	High	Negative	20	Inside
1220	L07	Storm beaches creation	Low	Positive	10	Outside
2110	G01.02	Walking	High	Negative	<1	Inside
2120	G01.02	Walking	High	Negative	1	Inside
2120	G01.03.02	Vehicle tracks	Medium	Negative	<1	Inside
2120	J02.12.01	Large cut maintained between lagoon and sea	High	Negative	<1	Inside
*2130	A04.03	Abandonment of pastoral systems	High	Negative	100	Inside
*2130	D01.01	Paths, tracks, cycling tracks	High	Negative	<1	Inside
*2130	G01.02	Walking	High	Negative	2	Inside
*2130	G01.03.02	Vehicle tracks	Medium	Negative	<1	Inside
*2130	I01	Invasive non-native species	High	Negative	1	Inside
*2130	J02.12.01	Large cut maintained between lagoon and sea	High	Negative	5	Inside
*2130	K02.01	Succession to scrub	Medium	Negative	5	Inside
2190	A08	Eutrophication	Medium	Negative	1	Inside
2190	G01.02	Walking	High	Negative	5	Inside
2190	G01.03.02	Vehicle tracks	Medium	Negative	<1	Inside
2190	G05.01	Trampling	High	Negative	<1	Inside
2190	J02.07.01	Drainage	High	Negative	10	Inside

2.2 Annex I habitat assessments

The conservation status of the Annex I habitats at Lady’s Island Lake is discussed below. The present conservation status in 2016 is compared with the baseline status and if a habitat is not in Favourable status, the main reasons for the Unfavourable assessment are given. Areas recorded in 2016 are compared with the revised baseline areas. It should be borne in mind that natural processes such as erosion, deposition and succession are primary drivers of change on coastal habitats.

2.2.1 1210 Annual vegetation of drift lines

1210 Annual vegetation of drift lines was mapped in two separate locations at Lady’s Island Lake. The first was located west of Carnsore Point, while the second was north of Crossfintan Point. As this habitat was not mapped during the CMP no comment can be made on whether the condition of the habitat is improving, deteriorating or remaining stable.

Area

The area of **1210 Annual vegetation of drift lines** mapped during the VSM was newly formed since the CMP. There were no signs of anthropogenic loss of habitat area and Area was assessed as Favourable in 2016.

Structure and Functions

Four monitoring stops were recorded in **1210 Annual vegetation of drift lines**, with all Structure and Functions assessment criteria passing. Structure and Functions were assessed as Favourable during the VSM.

Future Prospects

There were no impacts recorded for **1210 Annual vegetation of drift lines** in 2016. Future Prospects were assessed as Favourable during the VSM.

Conservation assessment

1210 Annual vegetation of drift lines was assessed as Favourable during the VSM.

2.2.2 *1220 Perennial vegetation of stony banks*

1220 Perennial vegetation of stony banks was located south of Lady's Island Lake, west of Carnsore Point, and north and south of Crossfintan Point. The NSBS classified the **1220 Perennial vegetation of stony banks** at this site as a vegetated lagoonal system and it is defined as a bar and as a fringing beach following Chapman (1976).

Area

Area was assessed as Favourable during the CMP. The area of **1220 Perennial vegetation of stony banks** decreased from 1.42 ha during the CMP to 1.25 ha during the VSM due to succession to **2110 Embryonic shifting dunes**, natural erosion and anthropogenic activities (shingle extraction). The **1220 Perennial vegetation of stony banks** habitat also increased in area in some locations, particularly due to the deposition of gravel after extreme storm events, however these increases were not enough to offset the losses. As there was a loss of area due to anthropogenic activities which was equivalent to less than 1% per year since the CMP, Area was assessed as Unfavourable-Inadequate (deteriorating) during the VSM.

Structure and Functions

One criterion failed in the Structure and Functions assessment. The presence of rock armour, that appears to have been built/maintained since 1995, is impacting negatively on natural sediment dynamics for this habitat. During the CMP, Structure and Functions were assessed as Favourable. Structure and Functions were assessed as Unfavourable-Inadequate (deteriorating) during the VSM.

Future Prospects

Shingle extraction and rock armour (recorded at Crossfintan Point) impacted negatively on 2% and 20% of **1220 Perennial vegetation of stony banks** respectively. Storm activity was recorded as a positive impact on 10% of the habitat due to the fact that storm beaches were created by storms throwing up shingle from the sea, thus creating new habitat for colonisation by perennial plants. Future Prospects were assessed as Favourable during the CMP, however rock armour was recorded as a negative impact affecting an unknown area of this habitat. Future Prospects were assessed as Unfavourable-Inadequate (deteriorating) during the VSM.

Conservation assessment

1220 Perennial vegetation of stony banks was assessed as Favourable during the CMP and as Unfavourable-Inadequate (deteriorating) during the VSM due to the presence of rock armour over-stabilising the habitat and shingle extraction.

2.2.3 2110 Embryonic shifting dunes

2110 Embryonic shifting dunes were located in four distinct areas at the front of the dune system, with the longest stretch of habitat approximately 2.5 km in length, running from south of Lady's Island Lake east to Carnsore Point.

Area

The area of **2110 Embryonic shifting dunes** decreased from 4.13 ha during the CMP to 3.55 ha during the VSM due to natural processes, namely succession to **2120 Marram dunes (white dunes)** and ***2130 Fixed dunes (grey dunes)**. Area was assessed as Favourable during the CMP and as Favourable (stable) during the VSM.

Structure and Functions

All of the assessment criteria passed the Structure and Functions assessment. Structure and Functions were assessed as Favourable during the CMP, and as Favourable (stable) during the VSM.

Future Prospects

Walking was recorded as a negative impact at Lady's Island Lake, affecting less than 1% of the **2110 Embryonic shifting dunes**. Future Prospects were assessed as Favourable during the CMP and Unfavourable-Inadequate (deteriorating) during the VSM.

Conservation assessment

2110 Embryonic shifting dunes at Lady's Island Lake were assessed as Favourable during the CMP and as Unfavourable-Inadequate (deteriorating) during the VSM due to the negative impacts of walking on the habitat.

2.2.4 2120 Marram dunes (white dunes)

2120 Marram dunes (white dunes) stretch almost the entire length of the Lady's Island Lake site west of Carnsore Point; they are absent north of Carnsore Point however. For the most part, they are fronted by **2110 Embryonic shifting dunes**.

Area

2120 Marram dunes (white dunes) have increased in area from 2.69 ha during the CMP to 5.52 ha during the VSM. This is partially due to succession from **2110 Embryonic shifting dunes**, and also due to development in new areas and also those previously mapped as ***2130 Fixed dunes (grey dunes)** during the CMP which were subsequently eroded. Area was assessed as Favourable during the CMP and as Favourable (stable) during the VSM.

Structure and Functions

Two criteria failed the Structure and Functions assessment. Maintenance of a large cut between the lagoon and sea is on-going and these works impact negatively on the natural sediment dynamics. The cut is made in the Spring when water levels are highest, and this practice has been carried out since the 17th century to relieve flooding of surrounding farmland (Healy *et al.*, 1997). The second criteria to fail was rare species with the population of *Otanthus maritimus* that was recorded in the **2120 Marram dunes (white dunes)** continuing to decline. From a population with more than 1,717 flowering and non-flowering stalks in 1997 (Martin, 1998) the *Otanthus maritimus* population has declined to approximately 30 flowering and non-flowering stalks by the VSM in 2016. During the CMP, Structure and Functions were assessed as Favourable. Under current methodology, this would have been assessed as Unfavourable-Inadequate as the maintenance of the cut was also carried out during the CMP. Structure and Functions were assessed as Unfavourable-Inadequate (stable) during the VSM.

Future Prospects

Walking, vehicle tracks and maintenance of the cut between the lagoon and the sea all have a negative effect the **2120 Marram dunes (white dunes)**. During the CMP, Future Prospects were assessed as Unfavourable-Inadequate because of a combination of natural erosion and recreational activities. Only erosion from anthropogenic activities would have been taken into account under the current methodology, however due to the presence of recreational activities, Future Prospects would still have been assessed as Unfavourable-Inadequate during the CMP. Future Prospects were assessed as Unfavourable-Inadequate (stable) during the VSM.

Conservation assessment

2120 Marram dunes (white dunes) were assessed as Unfavourable-Inadequate during the CMP and as Unfavourable-Inadequate (stable) during the VSM largely due to on-going maintenance of the cut between the lagoon and the sea.

2.2.5 *2130 Fixed dunes (grey dunes)

***2130 Fixed dunes (grey dunes)** are the most extensive habitat at Lady's Island Lake site and are, for the most part, fronted by foredune habitats. They are the most landward habitat of the site, backed by agricultural land and the Lady's Island Lake lagoon.

Area

The area of ***2130 Fixed dunes (grey dunes)** increased from 46.61 ha to 47.55 ha between the baseline CMP survey and 2016, with both **2110 Embryonic shifting dunes** and **2120 Marram dunes (white dunes)** succeeding to this habitat. ***2130 Fixed dunes grey dunes** also developed in two new areas since the CMP. Area of ***2130 Fixed dunes (grey dunes)** was assessed as Favourable during the CMP and as Favourable (stable) during the VSM.

Structure and Functions

Five of the criteria failed in the Structure and Functions assessment. The criteria which failed assessed the number and frequency of positive indicator species, negative indicator species, non-native species, height of vegetation and anthropogenic impacts on sediment dynamics. ***2130 Fixed dunes (grey dunes)** are suffering from a lack of grazing. This can be seen by the low diversity (frequency within the habitat and number within stops) of positive indicator species, and also by the very tall vegetation

height. Negative indicator species were frequent, in particular *Pteridium aquilinum* and *Rosa* species, which are also indicative of habitat alteration due to a lack of grazing. The non-native invasive species *Hippophae rhamnoides* (sea buckthorn) is also too frequent, recorded within 33.3% of stops. As with **2120 Marram dunes (white dunes)**, maintenance of a large cut between the lagoon and sea is ongoing and these works impact negatively on the natural sediment dynamics for ***2130 Fixed dunes (grey dunes)**. During the CMP, Structure and Functions were assessed as Unfavourable-Bad because of the effects of recreational activities and the spread of *Pteridium aquilinum*. Structure and Functions were assessed as Unfavourable-Bad (stable) during the VSM.

Future Prospects

The entirety of ***2130 Fixed dunes (grey dunes)** is negatively impacted by a lack of cattle grazing. Scrub encroachment affects 5% of the habitat, and the non-native *Hippophae rhamnoides* is present in approximately 1% of the habitat. Walking and vehicle tracks are damaging approximately 2% of ***2130 Fixed dunes (grey dunes)**, while the maintenance associated with the cut between the lagoon and sea negatively affects 5% of the habitat. No positive impacts were recorded. During the CMP, negative impacts recorded for the habitat included abandonment of grazing practices, pressures from urbanisation, dumping, tracks, walking, trampling, quad bikes and the maintenance of the cut. Future Prospects of the habitat were assessed as Unfavourable-Inadequate, however under current methodology this would have been assessed as Unfavourable-Bad. Future Prospects were assessed as Unfavourable-Bad (stable) during the VSM.

Conservation assessment

***2130 Fixed dunes (grey dunes)** were assessed as Unfavourable-Bad during the CMP. ***2130 Fixed dunes (grey dunes)** were assessed as Unfavourable-Bad (stable) during the VSM. The Unfavourable-Bad assessment is largely due to the lack of grazing resulting in a species-poor, rank sward.

2.2.6 2190 Humid dune slacks

Eight **2190 Humid dune slacks** were mapped at Lady's Island Lake. They were all located within the ***2130 Fixed dunes (grey dunes)** running west of Carnsore Point to south of Chour.

Area

The area of **2190 Humid dune slacks** did not change between the baseline CMP survey and the VSM survey. They were assessed as Unfavourable-Inadequate during the CMP as it was felt that they had diminished in size due to desiccation exacerbated by urbanisation. As there was no change in area since the CMP, Area was assessed as Favourable (improving) during the VSM.

Structure and Functions

Two criteria failed in the Structure and Functions assessment. Two monitoring stops had less than three positive indicator species; in fact one stop had none. The forb: grass ratio criterion also failed assessment, with five of the eight stops having less than 30% forb cover and more than 70% grass cover. There was some indication of eutrophication within **2190 Humid dune slacks** at Lady's Island Lake which may help explain the dominance of grasses over forbs and a lack of positive indicator species within some stops. During the CMP, Structure and Functions were assessed as Unfavourable-

Inadequate due to disturbance from recreational activities and negative indicator species. Structure and functions were assessed as Unfavourable-Inadequate (stable) during the VSM.

Future Prospects

Negative impacts included possible eutrophication as indicated by the presence of *Urtica dioica* within **2190 Humid dune slacks**, walking, vehicle tracks, trampling and drainage. During the CMP, Future Prospects were assessed as Unfavourable-Bad due to recreational impacts and a lowering of the water table due to increased urbanisation tapping into the local groundwater. There was no evidence of desiccation of the **2190 Humid dune slacks** during the VSM. Future Prospects were assessed as Unfavourable-Bad (stable) during the VSM.

Conservation Assessment

2190 Humid dune slacks were assessed as Unfavourable-Bad during the CMP. **2190 Humid dune slacks** were assessed as Unfavourable-Bad (stable) during the VSM. The Unfavourable-Bad assessment is largely due to evidence of eutrophication and recreational activities.

3 DISCUSSION

3.1 Species lists for 1220 Perennial vegetation of stony banks communities

Two communities of **1220 Perennial vegetation of stony banks** were recorded during the VSM – a pioneer and grassland community. Table 5 presents the positive indicator species recorded within the pioneer community of **1220 Perennial vegetation of stony banks** at Lady’s Island Lake. No monitoring stop was recorded within the small grassland community, but species of note were abundant *Festuca rubra*, and occasional *Leymus arenarius* and *Beta vulgaris* subsp. *maritima*.

Table 5. Positive indicator species recorded within the pioneer community of **1220 Perennial vegetation of stony banks** at Lady’s Island Lake. Negative and non-native species are excluded from the list.

Pioneer community			
<i>Anagallis arvensis</i>	<i>Carex arenaria</i>	<i>Eryngium maritimum</i>	<i>Plantago coronopus</i>
<i>Anthyllis vulneraria</i>	<i>Catapodium rigidum</i>	<i>Euphorbia paralias</i>	<i>Polygonum oxyspermum</i> s. <i>raii</i>
<i>Atriplex laciniata</i>	<i>Cochlearia officinalis</i>	<i>Festuca rubra</i>	<i>Rumex crispus</i>
<i>Atriplex prostrata</i>	<i>Crepis capillaris</i>	<i>Glaucium flavum</i>	<i>Senecio vulgaris</i>
<i>Beta vulgaris</i> s. <i>maritima</i>	<i>Crithmum maritimum</i>	<i>Honckenya peploides</i>	<i>Sonchus</i> species
<i>Cakile maritima</i>	<i>Elytrigia juncea</i>	<i>Hypochaeris radicata</i>	<i>Tripleurospermum maritimum</i>
<i>Calystegia soldanella</i>	<i>Erodium maritimum</i>	<i>Lotus corniculatus</i>	

3.2 Shingle vegetation substrate and composition

The vegetation of the pioneer community of **1220 Perennial vegetation of stony banks** is rooted within a sandy substrate for stops 1 and 4, and a gravel / sand / organic mixed substrate for stops 2 and 3. The shingle comprises pebble and gravel as defined using a modified version of the particle size ranges defined in Fossitt (2000). Gravel is the major component in all stops (Table 6).

Table 6. Shingle composition (as defined in Fossitt (2000) with minor modifications) of **1220 Perennial vegetation of stony banks** at Lady’s Island Lake during the VSM 2016. % cover shown, recorded to the nearest 5%. Only stops with exposed shingle could contribute to the data presented.

	Stop 1	Stop 2	Stop 3	Stop 4
Boulder (>256 mm)	0	0	0	0
Cobble (>64-256 mm)	0	0	0	0
Pebble (>16-64 mm)	5	0	5	45
Gravel (2-16 mm)	95	100	95	55

3.3 *Otanthus maritimus*

Lady’s Island Lake is the last remaining site for *Otanthus maritimus* within Ireland. It was found during the CMP, and again during the VSM. The population of this notable species was recorded as 30 flowering and non-flowering stalks covering a 30 m x 10 m area during the VSM, a decline from 1,717 flowering and non-flowering stalks in 1997 (Martin, 1998). For the continued survival of *Otanthus maritimus* at the site management practices should ensure that an open community is maintained as the species appears to decline in a taller *Ammophila arenaria* dominated sward.

3.4 *Hippophae rhamnoides* (Sea-buckthorn)

Hippophae rhamnoides has formed small dense thickets in several parts of the ***2130 Fixed dunes (grey dunes)** at Lady’s Island Lake. This is a highly invasive species on sand dunes in Ireland, which reduces plant species diversity and excludes rare species (Binggeli *et al.*, 1992). It may also contribute to drying out dune slacks through evapotranspiration. The plant spreads quickly by suckering and is an Amber listed invasive plant species (ISI, 2016).

3.5 Agriculture

There is a lack of grazing at Lady’s Island Lake that is impacting negatively on the ***2130 Fixed dunes (grey dunes)** in particular. The rank nature of both the **2130 Fixed dunes (grey dunes)** and **2120 Marram dunes (white dunes)** could also be contributing to the decline in the *Otanthus maritimus* population at the site which appears to thrive in a shorter more open sward (Martin, 1998).

3.6 Flood Alleviation

According to Healy *et al.* (1997) breaching of the sand/shingle barrier at the southern end of Lady’s Island Lake lagoon has been ongoing since at least the 17th century. The cut is made in Spring when the water levels are highest and is carried out to relieve flooding of surrounding farmland and the pilgrimage route around Lady’s Island. While modifications to the hydrology of the site only impact on the sand dune habitats by the physical footprint of the cut and upset to sediment dynamics, modifications to the hydrological regime of the lagoon could lead to changes in salinity and upset the present feeding and breeding habitat for birds.

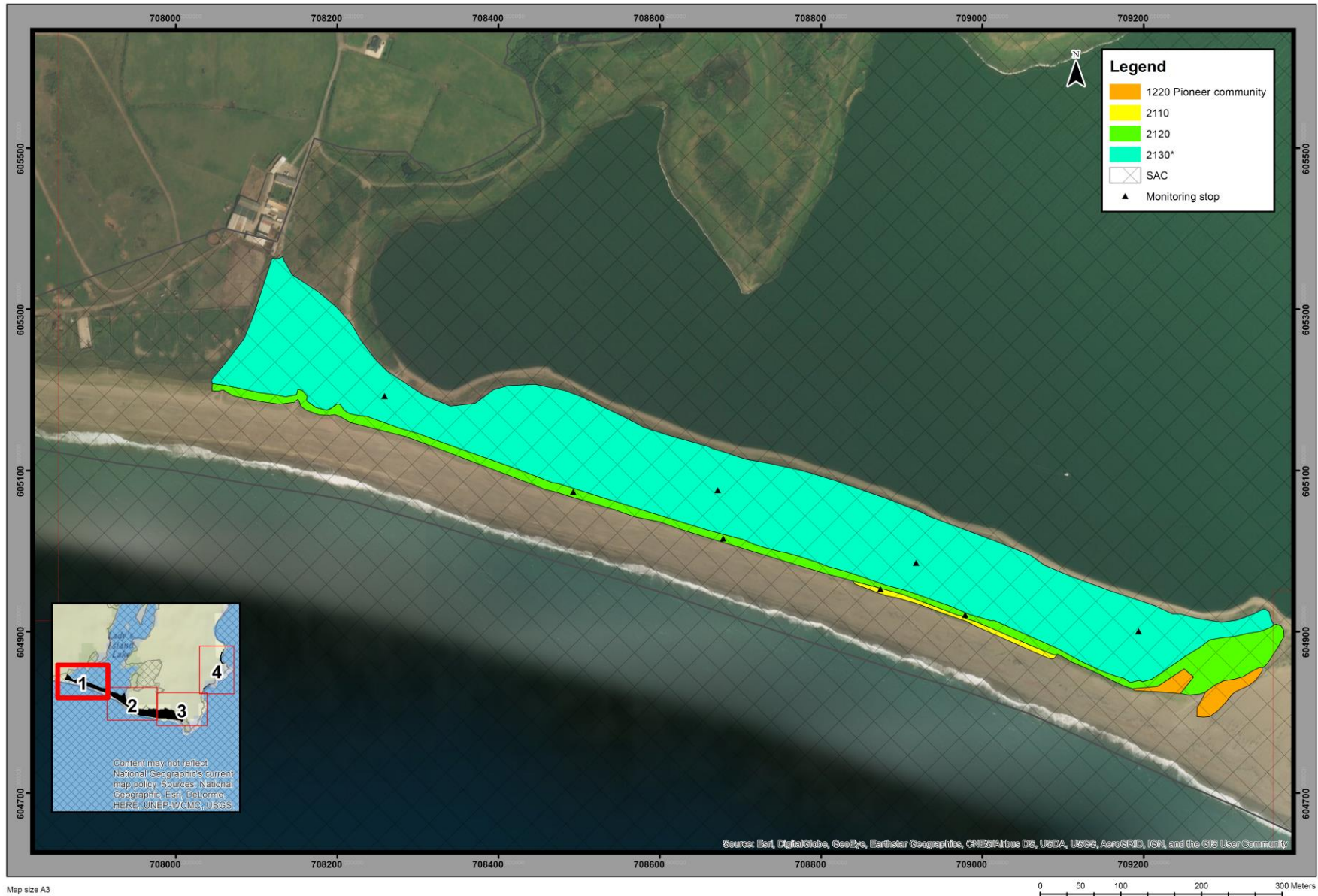
3.7 Climate change

Due to the extensive erosion of coastal systems within Ireland during the winter storms of 2013/14 and evidence that an increase in Atlantic storms over the last few decades could be due to climate change (Masselink *et al.*, 2016), the impact of climate change on all sand dune habitats, particularly the foredune habitats, should be assessed. Based on comparisons between the VSM mapping recorded in 2016 and the CMP mapping recorded in 2004, there has been a very small loss of sand dune habitats along the seaward side of the site, north of Carnsore Point. Although there have been losses, the impact of climate change has not been assessed for this site however as it would be more appropriate if an assessment of this impact was made at the national level.

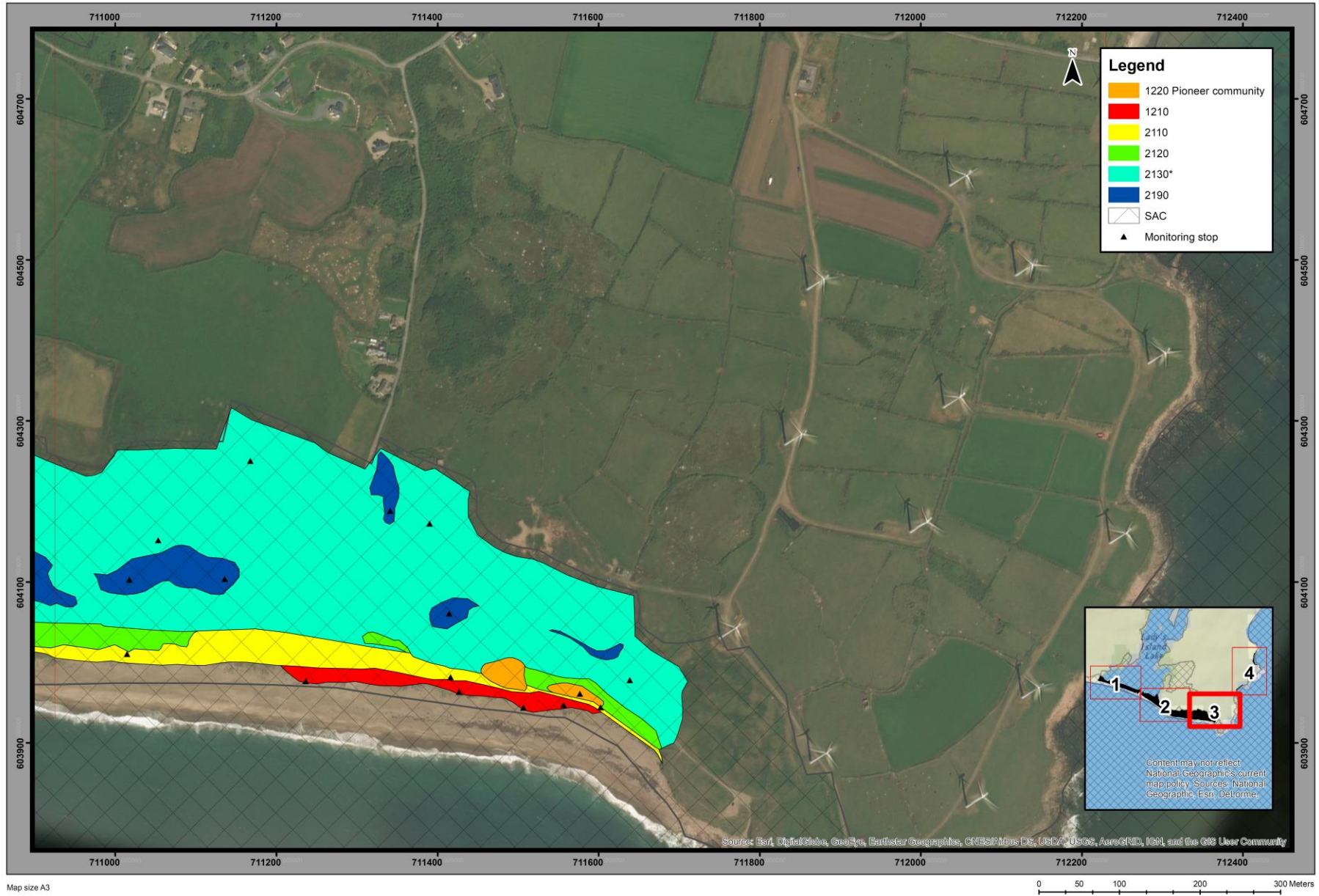
A site-specific management plan addressing the issues discussed in sections 3.3 to 3.6 would help improve the Future Prospects of **1210 Annual vegetation of drift lines, 1220 Perennial vegetation of stony banks, 2110 Embryonic shifting dunes, 2120 Marram dunes (white dunes), *2130 Fixed dunes (grey dunes), and 2190 Humid dune slacks**, and this would ultimately improve their overall conservation assessments.

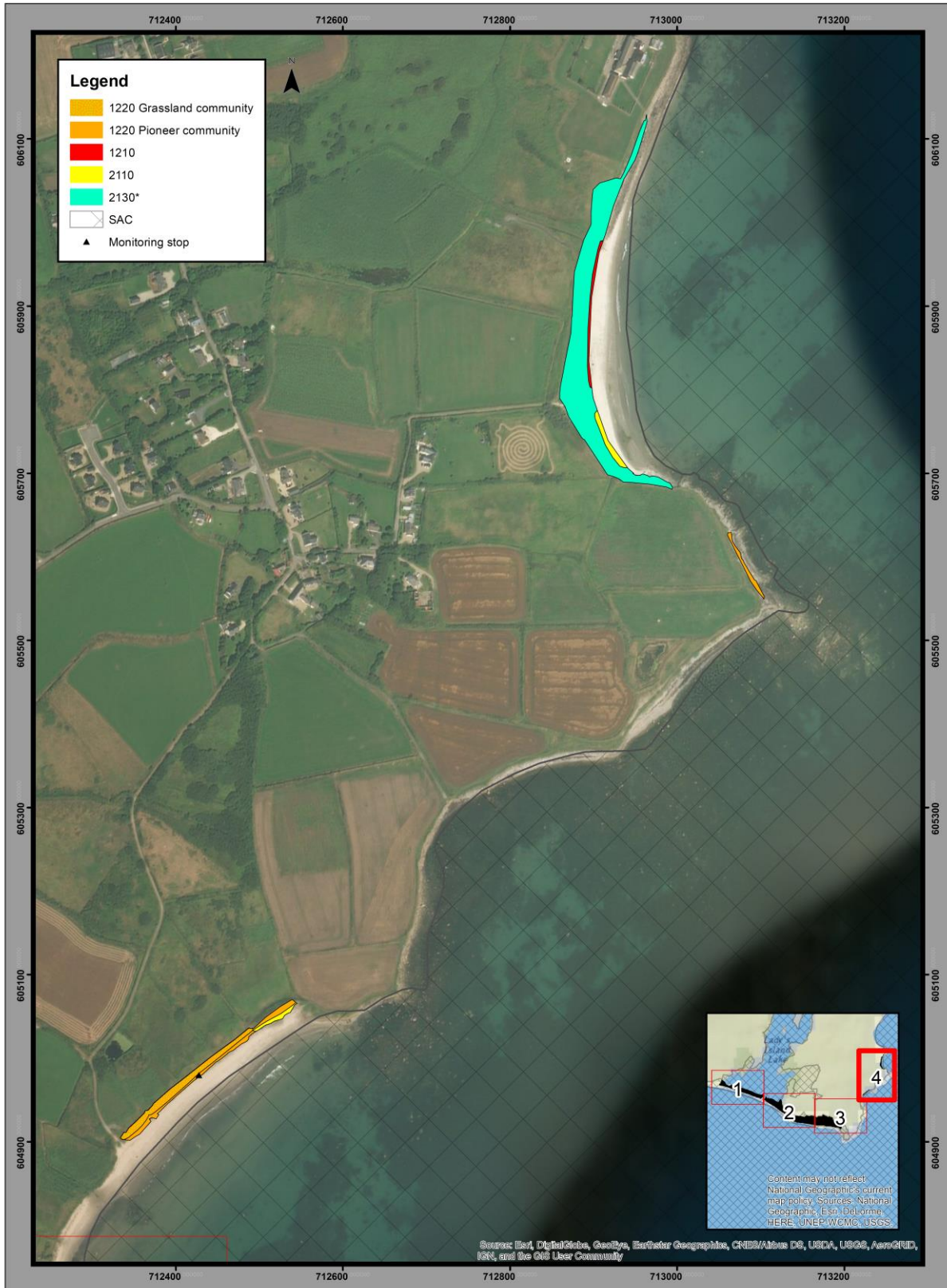
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Map size A3

0 50 100 200 300 Meters