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Foveran Links SSSI
NCA Review – Earth Sciences

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Summary and Recommendation:

1. The construction of Menie Links Golf Course within Foveran Links SSSI has removed the vast majority of the geomorphological interest within the vicinity of the golf course. Therefore there are insufficient scientific interests to merit a geomorphological SSSI within the Menie Links. Given the absence of the supporting geomorphological processes, this analysis suggests that the ecological designation is untenable within the foot print of the golf course.
2. The earth science interests remain within the GCR site within the northern half of Forvie Links.
3. Two of the SSSI's most striking features have been destroyed: 99% of the Menie sand sheet has been lost as a result of the golf course, 90% of the Sandend Burn sand sheet has also been lost.
4. Whilst not pre-judging the ecological advice, my recommendation is that de-designation of the Menie Links part of the SSSI is justified based on the loss of landforms and processes, and that a new southern boundary for the SSSI is considered further north, either coincident with the GCR site or from Drums Burn to incorporate ecological interests within the southern part of Foveran Links.

Contents

Aim of this document

This document supports SNH's Nature Conservation Act Review at Foveran Links SSSI by reviewing the geomorphological / earth science interests that remain following the construction of The Trump International Championship Golf Course. This part of the review will consider what geomorphological interests remain within various parts of the SSSI and should be considered alongside a review of the ecological interests.

Introduction and Context

The Foveran Links Site of Special Scientific Interest (SSSI) lies to the south of the River Ythan and contains three dune sections: Foveran Links in the north, Drums Links in the centre and Menie Links in the south of the SSSI (Figure 1). Whilst Menie Links extends southwards, this review focusses on the scientific interests within the SSSI.

Whist Foveran Links SSSI is notified for both its geomorphological and ecological interests; within Menie Links it is the ecological features which are designated. Strictly speaking the earth science or geomorphological designated interests lie within the Forvie Geological Conservation Review (GCR) site within the northern part of Foveran Links (Figure 1). The GCR encompasses a minimum selection of the best earth science sites across the UK. The sand dunes within Menie Links were not considered in the initial GCR review (between 1977 and 1990) however Hansom (2007) appraised the features in the Menie Links and found them to be of GCR quality (but they were not designated as such). The designated features which were being appraised at the Public Local Inquiry were ecological. Nevertheless during the Public Local Inquiry in 2008 the geomorphology within Foveran Links was acknowledged to have at least nationally important earth science features. Furthermore, in practice the geomorphology and ecology are inextricably linked, even more so on such dynamic sites.

Following planning consent issued after the Public Local Inquiry, Trump International Golf Links Scotland (TIGLS) constructed a golf course across Menie Links which overlaps with the southern third of the SSSI. This report supports SNH's Nature Conservation Act Review of the interests of the site to assess what impact the development has had, and how to manage the (remaining) designated interests.

This report outlines the former and current geomorphological interests of Foveran Links SSSI as a whole. It draws evidence from a range of sources, including evidence from the Public Local Inquiry, aerial surveys and site visits.

Structure of document

This document outlines the guidance on denotification, and then briefly introduces the three sand dune systems (i.e. 'links') within the SSSI boundary. The report then outlines the scientific interests within Menie Links prior to the golf course development and describes the changes following construction. The changes to the scientific interests have been quantified through various analyses: including a simple land use classification to identity the changing extent of natural areas (where natural landforms and processes are unhindered) and managed areas (where the natural landforms and processes have been influenced, removed, damaged or suppressed). Then 'special interests' of

the Menie Links are considered, alongside before and after photography. Finally a mention is made to the remaining interests of the SSSI to the north, beyond the championship course. A recommendation is made at the end of the document (and summarised on page 2). Appendices include supplementary information.

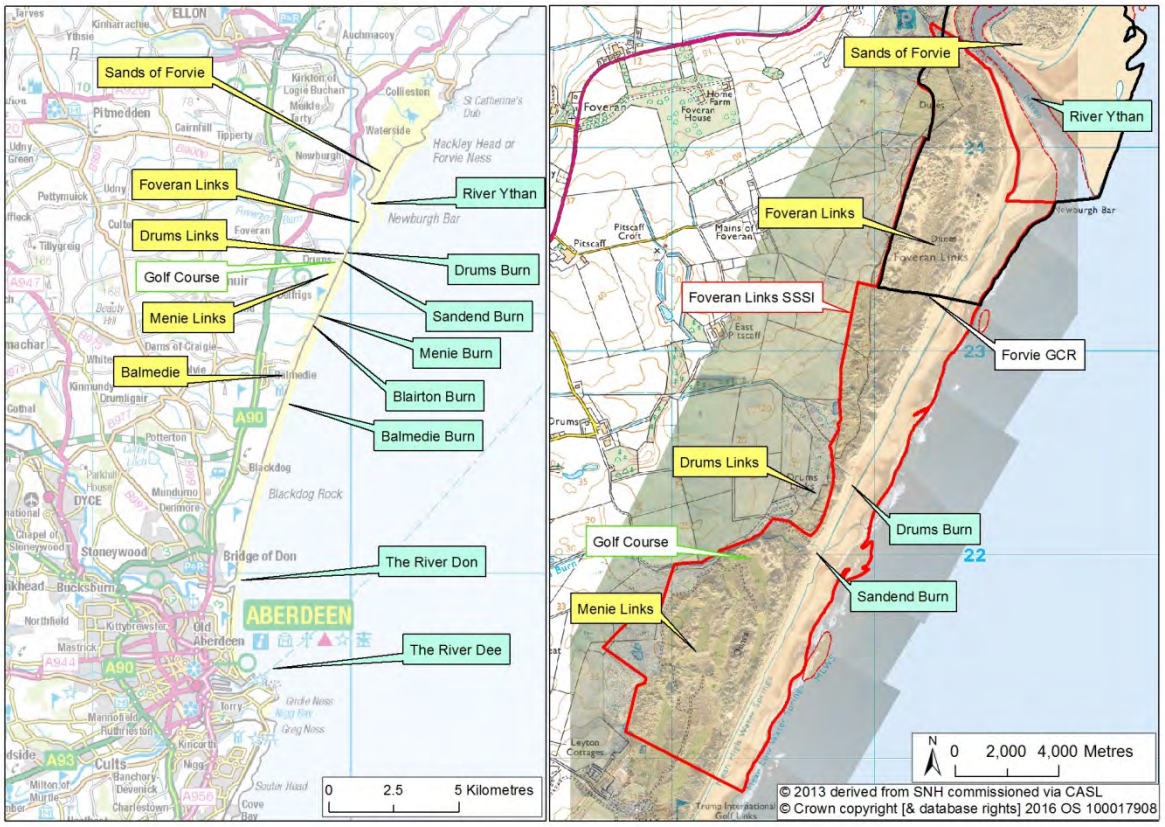


Figure 1 Location map for Foveran Links SSSI.

Guidance on denotification of a SSSI

SNH Guidance

SNH guidance on denotification has been consulted (**SSSI Denotification**). Sites or parts of site may only be proposed for denotification when the retention of that land within an SSSI cannot be otherwise justified. It notes the circumstance how qualifying natural features can be lost. At Menie Links the category would be

'*(d) the natural feature has declined, lost or damaged beyond reasonable expectations of recovery.*' The guidance continues stating, *'if the natural feature in question is the only special interest for which the SSSI, or a part of it, is notified and there are no new qualifying interests on that land, you might decide to denotify the SSSI in whole or part. '*

There is specific procedure where denotification is due to land lost to development:

'39. If land within a SSSI has been permanently damaged as a result of an authorised operation, it can be denotified using the provisions of section 9(5) of the 2004 Act. These provisions apply if the

public body that authorised the damaging operation (for example the construction of a house) consulted SNH in accordance with the relevant legislation when considering the original application.

40. Under this provision, the denotification of the land takes effect from the date of the initial denotification letter. The interested parties are not given 3 months in which to make scientific representations to the denotification, and the initial proposal to denotify does not need to be confirmed.

41. The denotification letter that SNH sends to the interested parties must state that the reason for the denotification is that the special interest of the land has been lost as a result of the permitted damaging operation, and that the notification is revoked from the date of the letter. Template letters for sending to owners and occupiers, and the other interested parties are at Annex 6 (for the denotification of complete SSSIs) and Annex 7 (for partial denotification).

42. A template newspaper advert is at Annex 8. This must be placed in at least 1 local newspaper on or around the date of the denotification letter.'

JNCC Guidance

The Joint Nature Conservancy Council issued guidance for the Geological Conservation Review (GCR) (link), which forms the UK level criteria for assessing the earth science interests of earth science SSSIs. Whilst the affected area of Foveran Links SSSI (Menie Links) are not designated for their earth science interests (they were not considered in the original review of GCR sites) these criteria have been consulted to ensure that the remaining earth science features of the SSSI (north of Drums Burn) are being appraised appropriately.

'*The rationale for the GCR can be encapsulated in four definitive statements, as follows:*

A. *The objective of the earth science SSSI system is to identify and conserve a GB wide series of Sites of Special Scientific Interest for their 'geology and physiography'.*
B. *Each site within the series must have a special interest demonstrable at national or international level, either in its own right or by virtue of its contribution to a network of closely related sites.*
C. *The special interest of the series is interpreted as the minimum number of sites needed to demonstrate our current understanding of the diversity and range of earth science features with regard to the following criteria:*
    - *representativeness*
    - *exceptional features*
    - *international importance*
D. *Sites are assessed against the above criteria on a network basis. Each network consists of a group of sites addressing a particular geological period of time, (for example, Kimmeridgian, covering the period from 140 to 135 million years ago), or subject area, (for example, fossil fish). The 97 networks are grouped into 5 sub-divisions covering the entire discipline of earth sciences. The resulting 3010 GCR sites are condensed into 2200 earth science SSSIs by virtue of the occurrence of different geological features at the same site.'*

The concepts of special interest, national and international interests and Criteria are explored further within the guidance.

Pre-development geomorphological interests:

Menie Links

The geomorphological interests of Foveran Links SSSI were appraised in 2007 (SNH, 2007. Commissioned Report 232) and made the following main findings:

"(1) Together, the dune systems of Foveran Links SSSI are of great scientific and natural heritage interest and represent a valuable geomorphological asset.

(2)The most striking feature at Menie Links in the southern part of Foveran Links SSSI is a large unvegetated sand sheet complex, over 600m long and over 400m wide. This vast sand sheet has remained active for most of the 20th century.

(3) Menie Links are nationally (and probably internationally) unique on account of the scale and dynamism of the sand sheet, the rate of inundation of adjacent dune features and the lack of human interference. It is one of the least disturbed sand dune systems in Britain. One notable element is the long-lived nature of the bare sheet of sand that dominates the area. The lack of vegetation colonisation suggests a vigorous aeolian environment hostile to the establishment of pioneer species and dune grasses that flourish on adjacent dunes.

(4) Amongst the very small number of comparable dune sites containing sand sheets in Scotland and elsewhere in Great Britain, the undisturbed sand sheet at Menie Links is the most extensive, dynamic and demonstrably systematic in its mode of transit of any such feature. Furthermore, in view of the relatively unique north-west European context of the north-east coast of Scotland, the Menie sand sheet is also of great interest and scientific value in an international context."

The southern section of the SSSI was not included within the shortlist of sites to be considered for the GCR review published in 2003. It should be noted that the ecological interests are inextricably linked to the geomorphological processes and landforms. Although the ecological interests are being appraised elsewhere, it is worthwhile explaining the interaction through the creation of a very rare habitat in the UK: young dune slacks. These slacks are created in the lee of mobile sand where the sand surface is deflated (lowered) down to the water table and then progressively colonised by specialist plants. The systematic movement of the Menie sand sheet (and in a similar sense the Sandend Burn sand sheet), resulted in the creation of 'stepping stones of young dune slack' which progressively mature though time and southwards, providing a very rare suite of habitats documenting the destruction, recycling and subsequent re-colonisation by specialist plants. The scale of dynamism and the habitats that were created were remarkable.

Sandend Burn sand sheet

The Sandend Burn sand sheet lies within the Menie Links section of dunes and measures 300 m by 200 m but contains similar processes and landforms as the Menie sand sheet. Hansom (2007) and Ritchie et al (1978, 1983) suggest that the sand sheets at Menie, Balmedie[1] and the Sandend burn, would have initiated through erosion and instability within the main dune ridge which created blow outs which have become 'self-maintaining' with ever greater amounts of wind is channelled through

[1] The Balmedie sand sheet is undesignated and is not part of the Foveran Links SSSI.

the blow out. Within a UK context the considerable extension of such instability within the interior of dunes is unusual (Hansom 2007), which makes these few examples on the Grampian coast rare.

The Sandend Burn sand sheet extends northwards from blow out corridors within the high main dune ridge. The systematic movement exposes damp deflation surfaces in its wake, which often expose the same former emerged marine terrace that exists under the Menie sand sheet. The movement of sand northwards has inundated mature dunes and is now abutting the Sandend Burn.

Foveran and Drum Links

'Foveran Links consists of a series of sub-parallel lines of massive, 10-12m high dunes with a well-developed wet slack between the broad coastal dune ridge and the sand-covered Holocene cliff-line which lies a few hundred metres inland. Low cliff-lines cut into glacial or glacifluvial deposits and emerged beach deposits are conspicuous features underlying much of Foveran Links and Drums Links. The beach comprises a series of shore-parallel intertidal bars with intervening runnels whose northward migration has deflected small streams in this direction. At the Ythan exit the northward drift has resulted in accretion, so that the beach is now 250m wide and backed by actively accreting embryo dunes (MacTaggart 1998) that were still present in 2006. In contrast to this essentially accreting area close to the Ythan exit, to the south the Foveran and Drums coastal edge is characterised by a foredune ridge which becomes discontinuous and severely undercut. High dune faces are produced along the eroded seaward edges and extensive unvegetated sand aprons have accumulated between and behind the eroding dunes, suggesting that whilst some sediment drift north occurs, there is also a significant movement of sand landwards.' (SNH, 2007)

Foveran Links has two large areas of bare sand which contain some of the similar features to Menie Links in form and process, but differ in that there is a greater level of human interference and smaller amount of young dune slacks being formed (Figure 2). The two areas of bare sand have moved northwards leaving dune slacks in their wake, in a similar process as the sand sheets further south. The more elongated sand sheets in Foveran Links contrast the 'teardrop' shaped sand sheet in Menie and are less striking as a result. The nationally significant landforms (and processes) are located within the northern half of Foveran Links and wholly within the GCR site (Figure 1), the remaining southern third of Foveran Links and Drums links contain less interesting dunes from a geomorphological perspective and are designated for their ecology alone.

Further discussion of the geomorphology within Foveran Links can be found in SNH (2007). However given the limited changes or pressures to date this description remains valid.

Figure 2 Map showing large areas of bare sand. Note this dataset (Sand Dune Vegetation Survey of Scotland) was surveyed in July 1999 and predates recent work and should be used for indicative purposes only (i.e. the extent of bare sand has changed).

Golf course construction

The construction of the golf course commenced July 2010 and was completed in 2012. The 10th to 18th holes partially or wholly lie within the southern third of the SSSI. As was anticipated at the Public Local Inquiry the sand sheet was used as a sand quarry to provide the necessary land-raising and cut and fill volumes for many of the golf holes. Fortunately SNH's aerial photography (copyright GetMapping) was taken during course construction and outlines the progress up to 2011[2]. The constructed golf course is shown on alongside the designated boundary in Figure 3.

Figure 3 Map showing the course layout with reference to the SSSI boundary, overlaid on 2013 aerial photography.

[2] Aerial imagery from 2006 (provided by TIGLS), 2011 (provided by SNH-GetMapping) and 2013 (provided by SNH-CASL) were used within this Review. Further information is provided in the Appendix.

Changes to land use 2006 - 2013

The geomorphological features are composed of the landform and processes, and as such are dynamic. Whilst these features are important in their own right they are also vital in maintain the ecological interests of the site, for example the northerly movement of the sand sheet progressively exposes deflated surfaces which are colonised by plants to form young dune slacks which over time becoming increasingly mature. This assessment initially considers the landforms and land-use types at three separate time periods (before, during construction and following construction of the golf course). Nevertheless it is self-evident where the processes have been affected by the development, aeolian processes cease to operate when a mobile sand dune is replaced by a fairway or other managed areas, conversely where landforms and processes are free from development the scientific interests may remain.

This section outlines the land-use changes based on analysis of aerial imagery and then considers the implications on the geomorphological features (i.e. landforms and processes) which support the notified ecological interests.

The following pages show the aerial photography from 2006, 2011 and 2013 annotated with key scientific interests. Whilst the foreshore is an important part of the designated dune system, it has been excluded from the area calculations, as a result statistics on bare sand only relate to areas inland of the vegetation edge, above Mean High Water Springs.

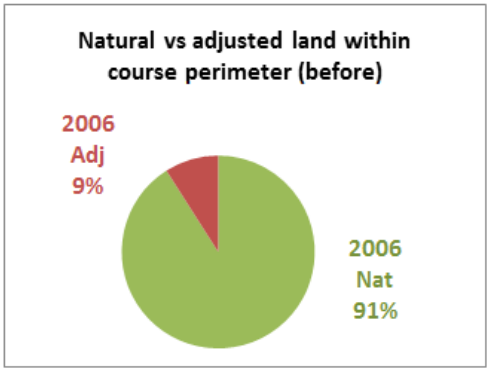
TIGLS commissioned air photography in early 2006, which depicted the largely undeveloped dunes within the southern section of Foveran Links SSSI (Figure 5). Analysis was undertaken within SNH, to categorise the various land use types documented within the time-series photography (See Appendix for methodology).

2006

The pre-development aerial photography is shown in Figure 5. It showed that most of the area was composed of natural vegetated dunes, followed by natural bare sand, with modest areas of standing water and dune slacks, managed grassland with small areas of paths and tracks (Table 1). When aggregated the natural areas dominate (i.e. largely unmanaged land uses) taking up 91% of the area with a small area of adjusted land (i.e. managed or man-made land-uses) taking up 9% (Table 1).

Table 1 Land use types within the foot-print of the golf course within the SSSI in 2006 (before construction).

Land use category (2006)	Area (m2)
Vegetated dunes (natural)	210,702
Bare sand (natural)	137,305
Standing water / Dune slacks	48,122
Managed grassland	38,168
Roads, tracks and paths	957
Other man-made feature	154
Grand Total	435,408



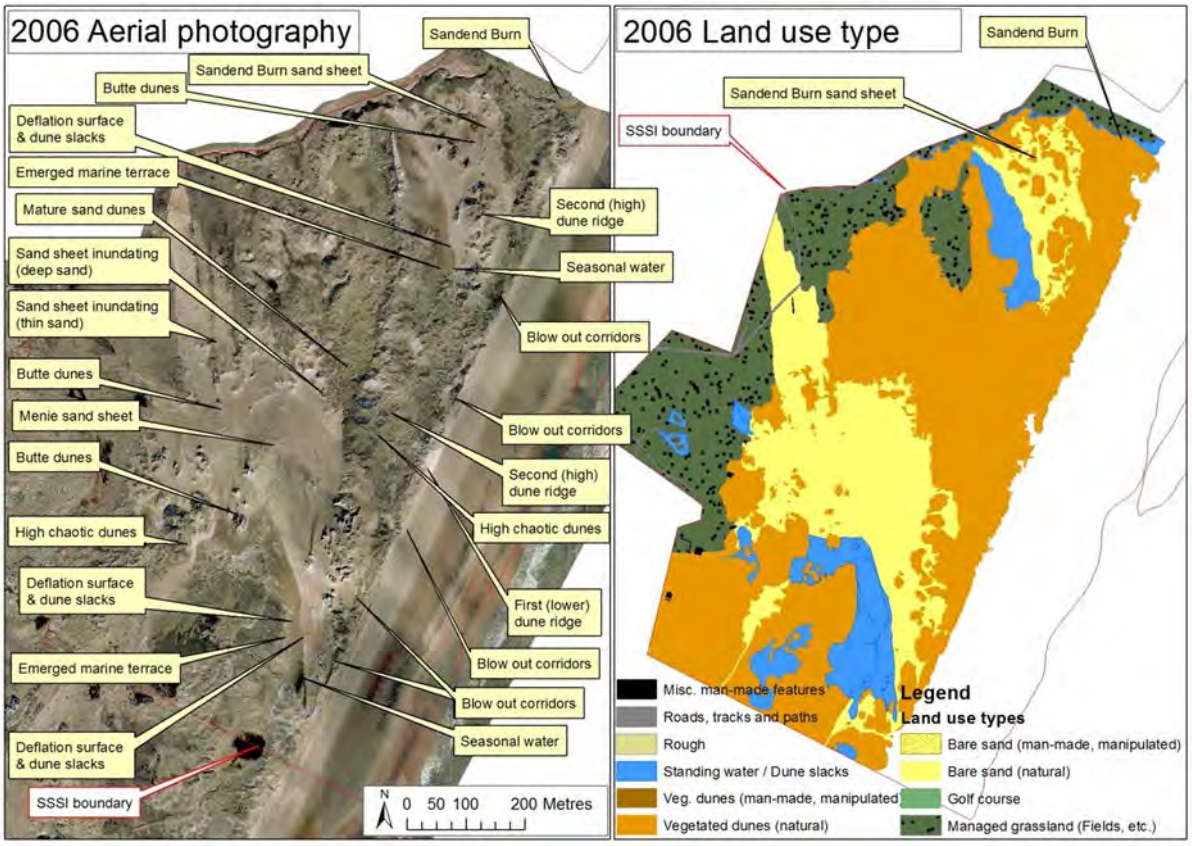


Figure 4 Key geomorphological interests annotated on top of 2006 aerial photography (© TIGLS) alongside the land use classification.

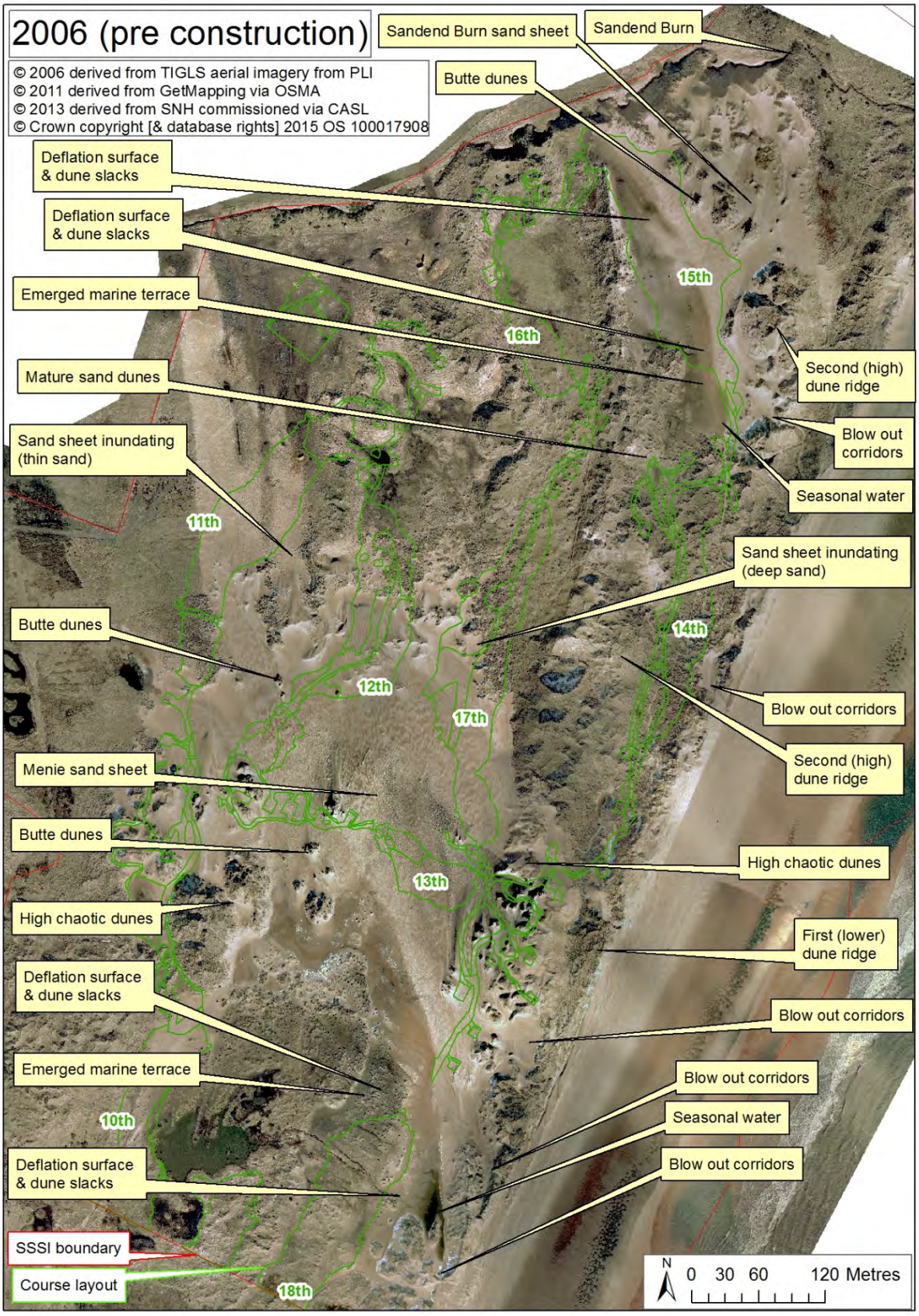


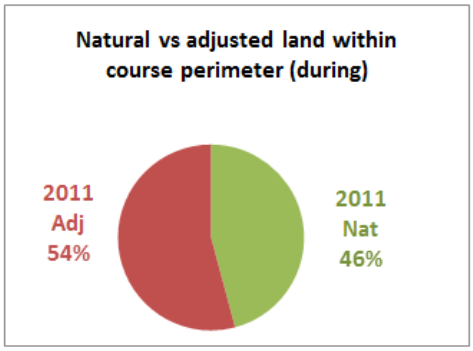
Figure 5 Enlarged aerial photograph of the southern third of Foveran Links SSSI, showing Menie Links and Sandend Burn sand sheets in 2006 (© TIGLS).

2011

Comparable analysis was undertaken using 2011 aerial photography to identify changes to land use during the construction phase. It showed that most of the area was composed of natural vegetated dunes however the proportion of adjusted and manipulated areas were increasing with large areas of bare sand (manipulated), modest areas of vegetated dunes (manipulated), roads, tracks and paths. Modest and small areas of standing water and dune slacks remained in 2011 along with managed grassland and natural bare sand. Near completed small areas golf course are also evident (Table 2). When aggregated the natural areas (i.e. largely unmanaged land uses) now form the slight minority taking up 46% of the area with a slight majority of the area 54% being made up of adjusted land (i.e. managed or man-made land-uses) (Table 2).

Table 2 Land use types within the foot-print of the golf course in 2011, during construction.

Land use category (2011)	Area (m2)
Vegetated dunes (natural)	163,041
Bare sand (manipulated)	150,391
Vegetated dunes (manipulated)	33,364
Roads, tracks and paths	29,460
Standing water / Dune slacks	23,538
Managed grassland	18,499
Bare sand (natural)	13,022
Golf course	4,092
Grand Total	435,408



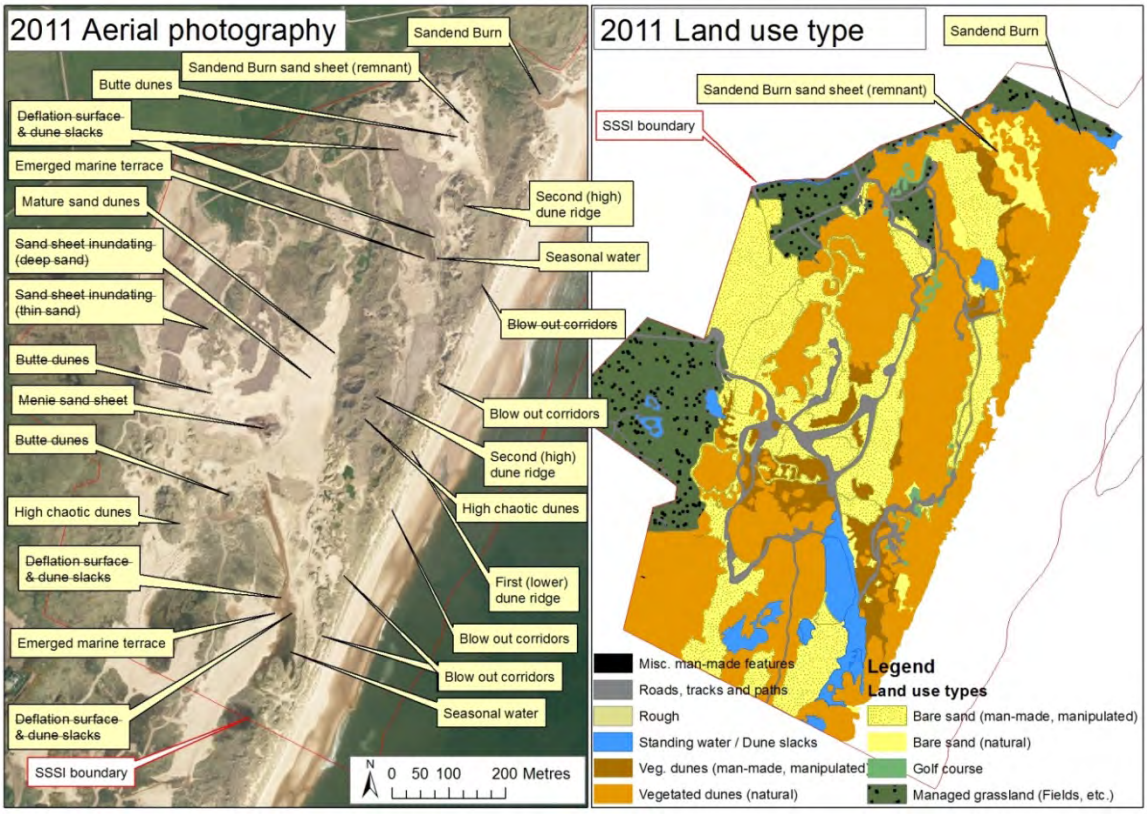


Figure 6 Key geomorphological interests annotated on top of 2011 aerial photography (© GetMapping) alongside the land use classification. Annotations which are struck though identify compromised / lost features due to the golf course.

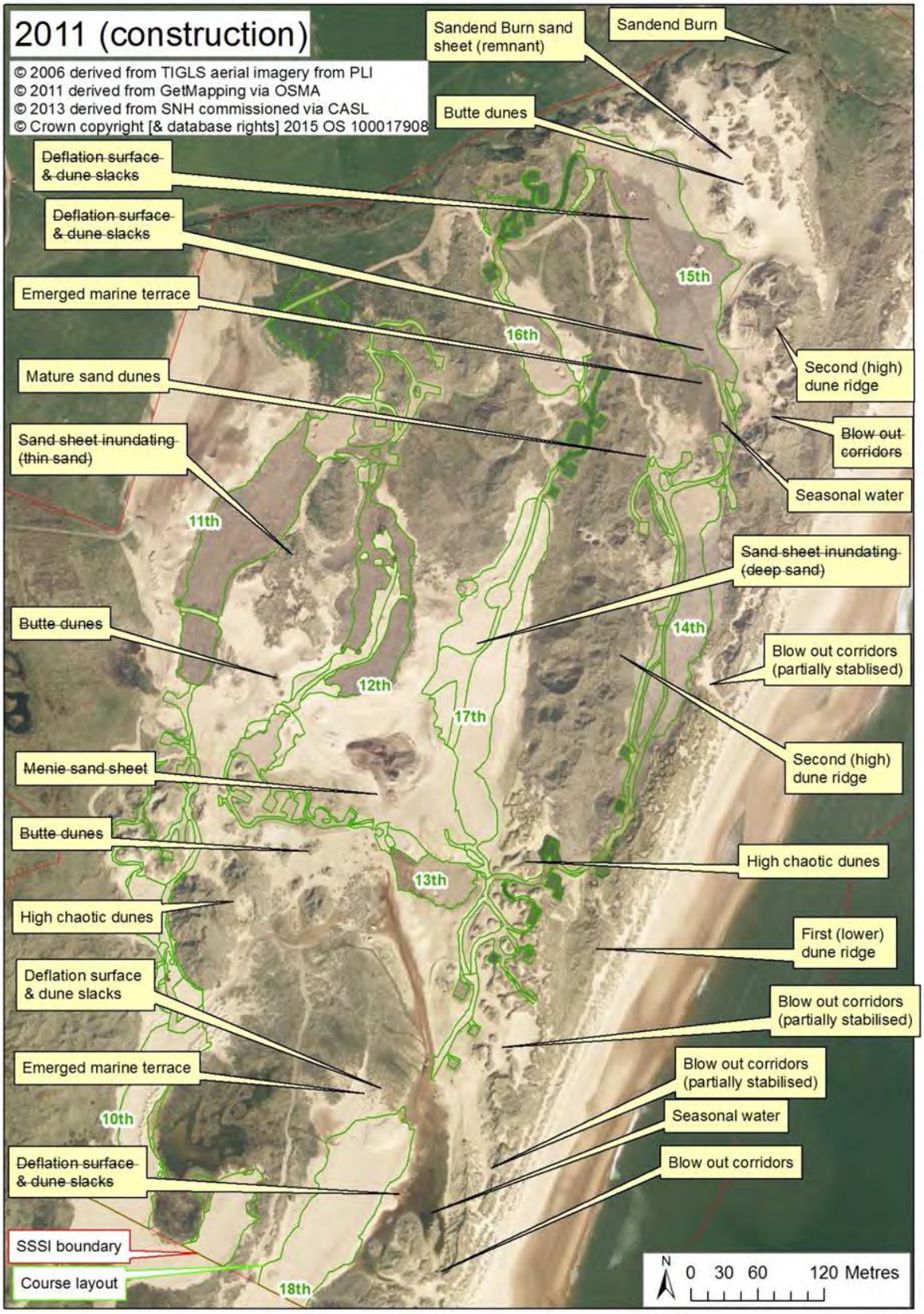


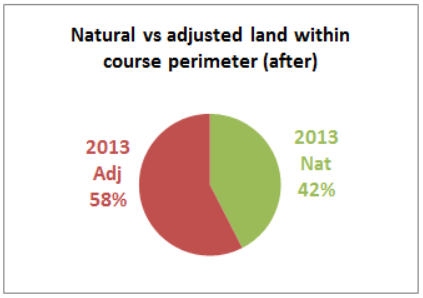
Figure 7 Enlarged aerial photograph of the southern third of Foveran Links SSSI, showing Menie Links and Sandend Burn sand sheets in 2011 (© GetMapping) Annotations which are struck though identify compromised / lost features due to the golf course.

2013

SNH commissioned aerial survey in 2013 which enabled comparable analysis to identify changes to land use following the construction of the golf course. It showed that the largest land use type is natural vegetated dunes, however the next largest is golf course, replanted (i.e. manipulated) vegetated dunes, followed by rough. Modest areas of managed grassland remain alongside standing water and dune slacks. Small areas of roads, tracks and paths, natural and manipulated bare sand and other man-made features also remain (Table 3). When aggregated the natural areas (i.e. largely unmanaged land uses) now form the minority taking up 42% of the area with a majority of the area 58% being made up of adjusted land (i.e. managed or man-made land-uses) (Table 2).

Table 3 Land use types within the foot-print of the golf course in 2013, after construction.

Land use category (2013)	Area (m2)
Vegetated dunes (natural)	159,295
Golf course	113,031
Vegetated dunes (manipulated)	81,060
Rough	28,378
Managed grassland	18,955
Standing water / Dune slacks	17,528
Roads, tracks and paths	8,567
Bare sand (natural)	8,076
Bare sand (manipulated)	497
Other man-made feature	21
Grand Total	435,408



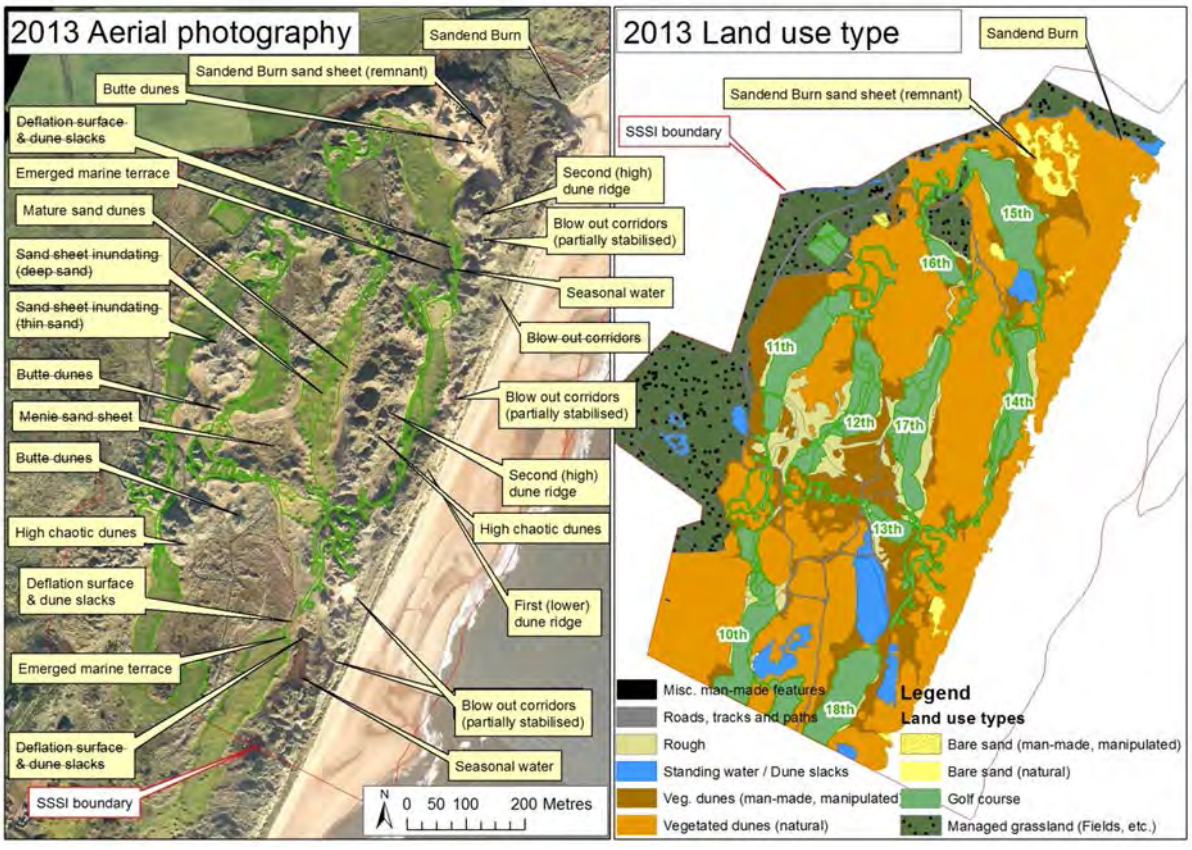


Figure 8 Key geomorphological interests annotated on top of 2013 aerial photography (© SNH) alongside the land use classification. Annotations which are struck though identify compromised / lost features due to the golf course.

Figure 9 Enlarged aerial photograph of the southern third of Foveran Links SSSI, showing Menie Links and Sandend Burn sand sheets in 2013 (© SNH). Annotations which are struck though identify compromised / lost features due to the golf course.

The distribution and extent of each land use type is compared side by side in Figure 10.

This analysis has calculated the land use changes based on an area defined by the outer edge of the golf course that lies within the SSSI. This total area is 43.5ha and in 2006 prior to construction there were 39.6ha of natural land and 3.9ha of man-made or adjusted land. By 2013 the natural areas had reduced to 18.5ha and the man-made or adjusted areas had increased to 25.1ha. In broad proportions before the golf course was constructed 91% of the land was natural and unmanaged, but after the golf course was constructed this had fallen to 42%.

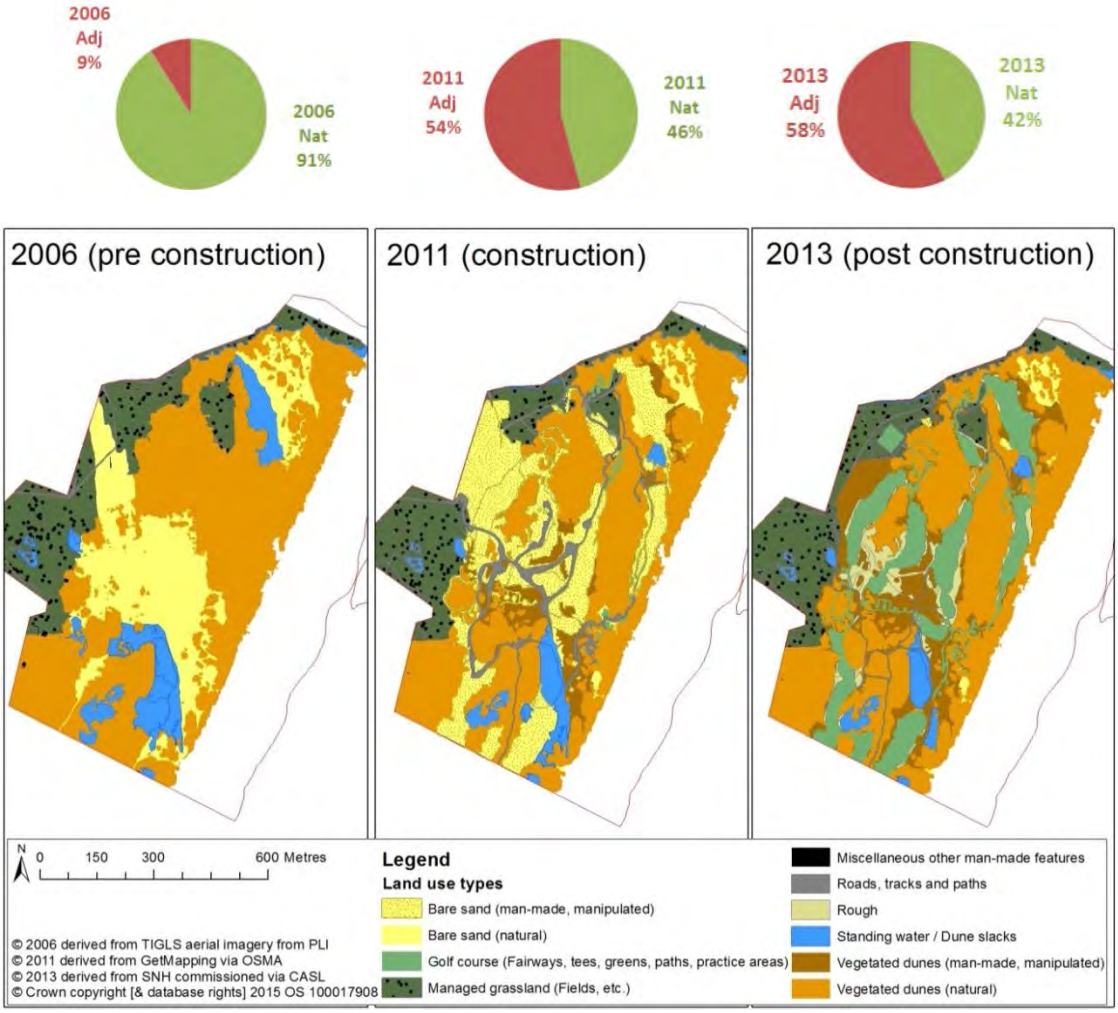


Figure 10 Land use change over view maps 2006, 2011, 2013. Note the bare sand on the beach has been excluded, so all references to bare sand are within the sand dunes, landward of the vegetation edge just landwards of MHWS.

Two dimensional changes in area have been calculated and used as the metric to reflect natural or modified land; however the modifications include three dimensional changes (land raising and lowering). Whilst an additional 49% of the area has been modified during the construction of the golf course, very large volumes of sand and soil have been transported around the site which further impact the scientific interests of the site. The particular interests of the Menie Links part of the SSSI was the lack of human interference, and therefore the dynamic landforms and their surrounding context were very largely controlled by natural processes. This has now changed whereby the landscape is greatly influenced by man-made as well as natural processes. This alters the mosaic of landforms and reduces the scientific interests.

A feature based description of changes at Menie Links between 2006 and 2013

The scientific interest of an assemblage of landforms extends beyond any simple metric like its area, which is why although the mapping analysis (above) is useful in quantifying the large-scale changes, it is necessary to also consider what landforms and processes that were operating in 2006 remain now that the golf course has been constructed. This section of the report is informed by a site visit made on the 24th and 25th June 2013.

The essence of the scientific interest at Menie Links

The following sections detail individual landforms and processes distributed across the SSSI, however the remarkable characteristic of Foveran Links SSSI, and in particular within the area of the northern part of the golf course was the vast scale and extent of unhindered processes which created, controlled and consumed landforms and habitats across hundreds of meters. Sand was free to be blown from the intertidal area, northwards through fore dunes, dune ridges, blow outs, deflation surfaces, up and over the sand sheet and be deposited within mature dunes to the north (Figure 11). On other sand dunes elsewhere in the country areas of dynamism are normally limited to a coastal fringe, or blow out corridors extending tens or perhaps a hundred meters inland. In the case of the Menie these unhindered processes dominated the 600m long and 400m wide sand sheet. Similar processes occurred within the Sandend burn sheet too. Such longstanding dynamism had occurred previously within the area; as such the geomorphological narrative was unique in a UK setting (SNH 2007).

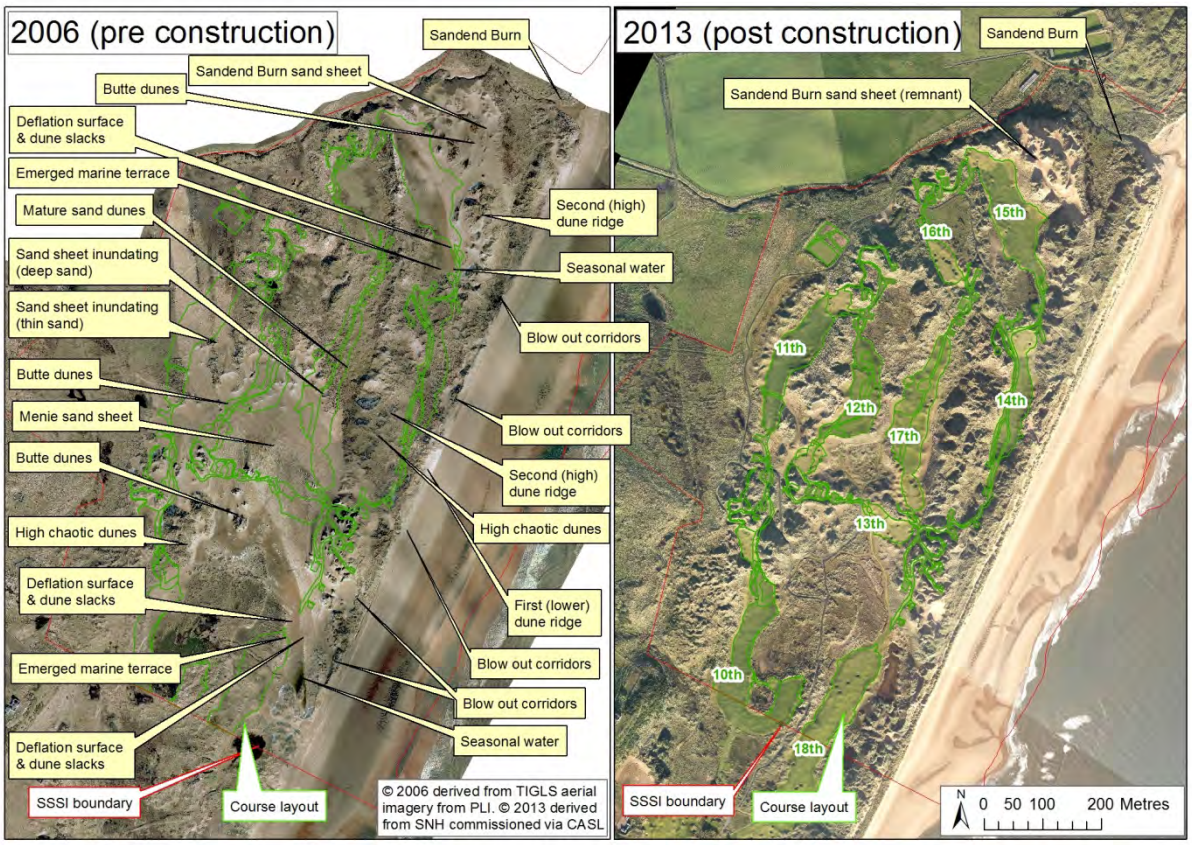


Figure 11 Before and after aerial photography at Menie sand sheet annotated with key geomorphological interests and the final course layout.

Whilst the Menie sand sheet dominates the southern third of the SSSI, the entire assemblage of features represents a classic site for coastal geomorphology. The geomorphological features were evaluated by Hansom (SNH 2007) and note the presence and exchange between the first dune ridge (adjacent to MHWS), second dune ridge (an active ridge further inland), hollows and dune slack, blowouts and remnant dunes which reflect the reactivation of formerly stable areas of dunes. Together they represent a remarkable assemblage of features which reflected the interaction of active geomorphological and ecological processes forming, recycling and reforming landforms of habitats in the absence of human interference.

Menie sand sheet and surrounding interests

The pre-development sand sheet measured up to 600 m by 400 m (Figure 12). The bare expanses of sand in 2006 extended northwards from the deflated young dune slacks in the south, narrow blowouts punctured surrounding dunes towards the periphery of the sheet, and within its interior butte dunes were formed as isolated fragments of an earlier mature dune landscape. As the sand sheet progressed northwards two sets of landforms collide: the steep cascading sand slope buries the pre-existing mature dune. This steep slope was evident along the eastern front of the sand sheet, and along the western front of the sand sheet a thinner layer of sand inundated areas.

It is clear from the aerial photography that nearly the entire Menie Sand Sheet complex has been stabilised (Figure 12), with a very small area of one of the blow outs to the southeast remaining. The bare sand within the Menie sand sheet extended across 105,000 m^2 in 2006, however only 1,000m^2 remains in 2013 (i.e. less than 1% remains within a feeder blowout within the coastal dunes). Most of the blow outs (which would have fed the sand sheet) are stabilised and reshaped. The highest part of the sand sheet (also known as the dome) is not recognisable and has been affected by the groundworks associated with the 12th, 13th and 17th holes, reflecting volumetric changes across the SSSI. The steep slope at the front of the sand sheet has been lost within the construction of the 17th fairway. The western front of the Menie sand sheet has been lost under the 11th and 12th holes.

Many of the 'butte dunes' remain within the vicinity of the 13th tee, however there has been considerable ground works within the adjacent area and the previously dynamic surroundings are now stabilised by marram sprigging and other (shorter / fescue) grasses. It is also worthy of note that the topography of the 'carry' on the 13th (i.e. the section between the tees and the fairway/apron of the green) appears confused and reworked. Little of the earlier natural landforms appear evident.

The north-western section of the Menie sand sheet has been stabilised and seeded underneath the 10th and 11th holes, resulting in a complete loss of dynamic processes and geomorphological interest.

The southern-most section of the sand sheet has also seen considerable reworking. This part of the SSSI was remarkable, in that it contained youngest dune slack, immediately behind the (northward vacating) sand sheet. It also was complicated by the remnants of an active oblique dune ridge, which was (according to the Rennie & Hansom, 2008) the next source area of sand to continue the development of the sand sheet. There have been considerable land raising and interference to the east of the 18th hole. The dynamic feeder areas to the sand sheet have been stabilised and modified.

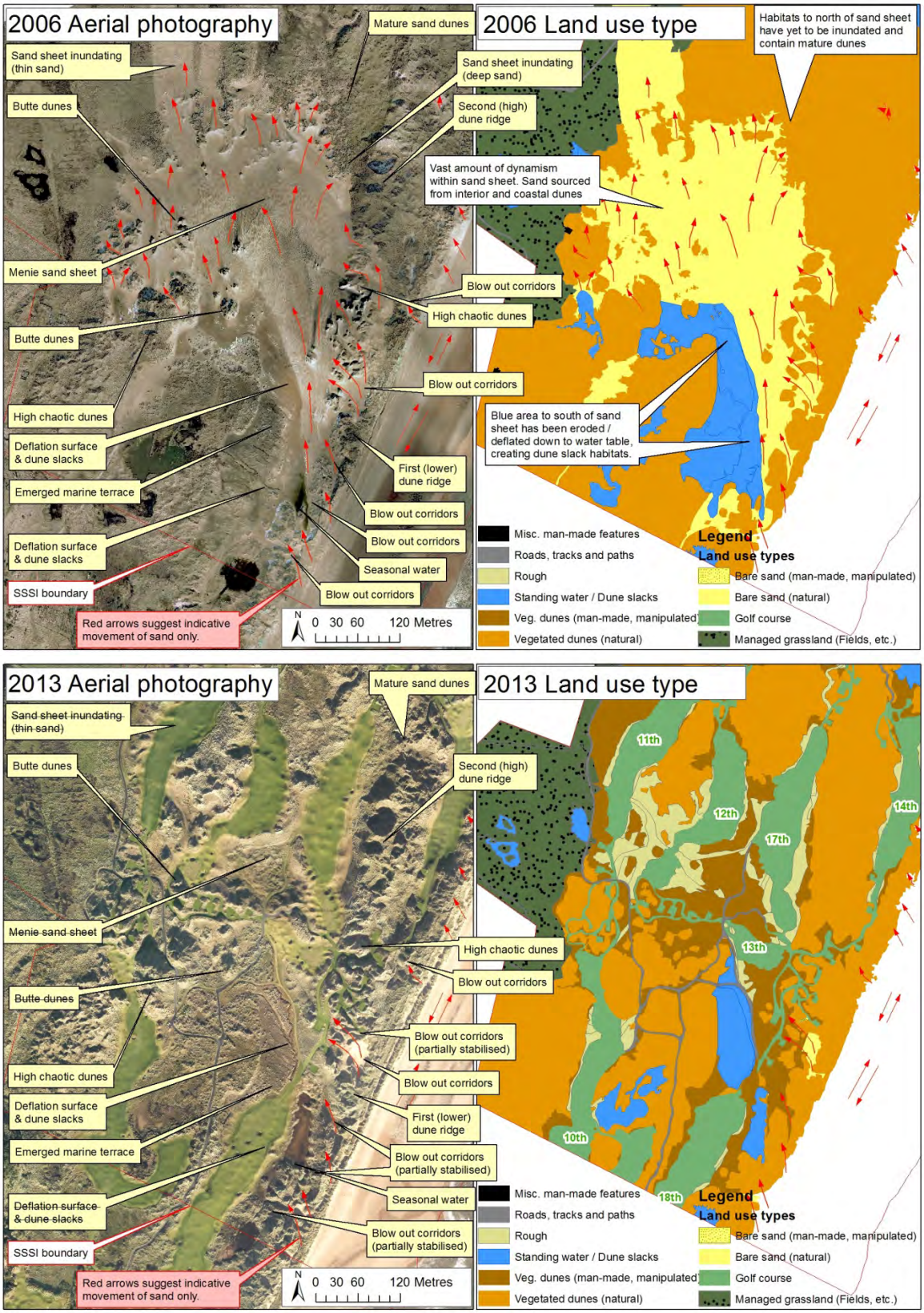


Figure 12 Comparison of key interests present in 2006 and remaining 2013 surrounding the Menie sand sheet. Note, red arrows are purely indicative; providing a sense of sand movement operational in 2006 and 2013.

Groundworks have created 'water-features' on the edge of the dune slack, which are now served by culverts which lie 0.5m above the water-level. The dunes adjacent to the dune slack / seasonal

loch have been reshaped and now contain pebbles and stones amongst the marram sprigging (see before and after pictures). The 'carry' area approaching the 18th fairway has encroached and cut across the previously expansive dune slack. The topographic reshaping has resulted in a less variable surface, where there were marked contrasts between bare, deflation and vegetated surfaces; the post-development landscape has less topographic contrasts and is in a process-sense now moribund.

Much of the deflation surface (and coincident dune slack) which lay to the south / west of the Menie sand sheet remains in 2013. The area of this deflation surface was calculated as 25,080 m^2 in 2006 and 10,250 m^2 in 2013 (i.e. some 41% remains). In addition to the percentage loss of landform and habitat area the northern section is separated by an access path which links the 10th, 13th and 18th holes. It is likely that there will also be changes to the groundwater and hydrology as a result of the surrounding land use changes from nutrient poor unmanaged mature sand dunes to irrigated, and potential nutrient and pesticide loading which may now be added on the adjacent golf course areas. The implications of hydrological and nutrient enrichment ground water aspects are beyond the scope of this investigation but the change in nutrient loading (from an entirely unmanaged dune system to a world class golf course) would be expected to have an implication in the long-term on adjacent areas.
Blow out corridors feeding the Main Dune Ridge have also been stabilised (to cut off the feed of sand to the sheets), which appears at odds with the reassurance within the Public Local Inquiry that Main Dune Ridge would be free from golf course development.

Before construction (April 2011) (arrows identify similar points)	After construction (June 2013) (arrows identify similar points)
Menie sand sheet and surrounding area	
 South from the high dunes, at one of the blow out corridors of the Menie sand sheet. Very dynamic area with sand being sourced and moved through former mature sand dunes. Seasonal loch infilling deflation hollow. The systematic changes here control sand sheet dynamics further down-wind (north).	 Extensive stabilisation of blow out corridors and unvegetated dunes, extensive land-raising of deflation surfaces for 18th fairway and tees. Reshaping of loch into water feature with culvert inflow.
 Looking south: Blow out corridors and surrounding (natural) dunes exclusively composed of sands, coarser material lower down relates to marine sediments.	 Looking east: Revegetated blow out corridors and land-raised dunes contain pebbles (i.e. non-windblown sediments within dunes).
 Unvegetated blow out corridors contribute and allow the free exchange of new sediment into the sand sheet, which continue unhindered across the rest of the sand sheet.	 Blow out corridors have been partially stabilised to minimise sediment input onto golf course. Surrounding interior dune areas have been stabilised raised and is now golf course.

Before construction (April 2011) (arrows identify similar points)	After construction (June 2013) (arrows identify similar points)
 Seasonal loch supplied by water table and overland flow.	 Seasonal loch now water feature with landscaped edge and is now supplied by culvert (the source of which is unknown)
 Looking north the emerged former marine surface (arrow) has been exposed as the sand sheet deflates and moves northwards, progressively exposing areas which young dune slack species inhabit. Dynamic bare sand to right is the southern end of the Menie sand sheet.	 Looking north-north-west the emerged former marine surface (arrow) now in bloom, foreground raised (to avoid seasonal water issue), vegetated and stabilised and criss-crossed with access paths and tees/greens. This was the southern end of the Menie sand sheet.
 Looking south, the top & western part of the Menie sand sheet very dynamic area with fragments of mature dune (centre) undercut to form butte dunes. Higher more extensive dunes (right, arrow). Unhindered natural processes dominating landforms & habitats	 Looking west towards top of former Menie sand sheet. Higher extensive interior dunes arrowed, centre ground (10th hole) within area of stabilised sand sheet. No active / windblown processes operating.

Before construction (April 2011) (arrows identify similar points)	After construction (June 2013) (arrows identify similar points)
 From centre of Menie sand sheet looking south, vast dynamic exchange of sediment from coast northwards (towards this location). Seasonal loch arrowed, next to deflation surface and start of sand sheet.	 Within stabilised area of Menie sand sheet looking south, no movement of sediment, revegetated dunes and short grasses throughout area. No active windblown processes.
 Menie sand sheet interior looking south towards butte dune (arrow), isolated and exposed through active undercutting by wind.	 Former sand sheet interior now stabilised (within vicinity of 13th hole, looking south). Confused topography within this area of original and remodified surfaces. Extensive stabilisation of marram and shorter grasses. The same butte dune arrowed. No active processes or features of geomorphological interest.

Between the Menie and the Sandend Burn sand sheets

The dunes between the Menie and Sandend Burn sand sheets are considered here. This area contained a variety of mature dunes, lying between two areas of instability (Figure 9). High dunes cross these areas and are separated by a large valley, which has now been occupied by the 14th Fairway (Figure 6 & pics below). The construction of this fairway involved land-raising to provide a more even playing surface, with the resultant loss of chaotic mature dunes beneath. Further inland mature dune has been affected in a similar way for sections of the 11th, 12th and 17th holes.

In an evolutionary sense this was the next area to be (partially) inundated and consumed by the Menie sand sheet. In process terms there was less dynamism than adjacent areas (note absence of red arrows on Figure 12), but within the context of the rapidly moving sand sheets to north and south, it provides interesting features. The subdivision and land-raising associated within the 11th, 12th and 17th holes diminishes the geomorphological interests in these areas.

Coastal dune ridge / 14th hole	
Before construction (April 2011)	After construction (June 2013)
 Natural and undisturbed area of expansive dunes, including natural transition between mobile, semi-fixed and fixed dunes. Menie sand sheet in the distance.	 This picture is taken from a more northerly & interior position (location/direction of other photo arrowed). The valley floor has been raised, widened and in-filled with fairway, land raising has allowed the construction of the tees (far distance)

Sandend Burn sand sheet

Towards the northern limit of the golf course a second sand sheet abuts the Sandend Burn. Whilst this sand sheet, measuring 300m by 200m, is much smaller than the Menie sand sheet it contained many of the interests found in the larger sheet to the south. The Sandend Burn sand sheet has a northward movement which buries mature dune landforms and habitats to its fore and leaves deflation surfaces in its wake, which have been progressively colonised by dune slack species. The instability fuelling this development (like the Menie sand sheet) starts within the high dune interior, but has a smaller input from the coastal dunes and beach. In the same way as the Menie sand sheet the geomorphological interests lie in the dynamic landforms, processes and habitats that it consumes and creates. So whilst attention is drawn to the sheet itself, the surrounding geomorphological context is of interest and importance, even if it has more limited (or no) dynamism. One difference with the Sandend Burn sand sheet is that it abuts and feeds sediment in to the burn, where sediment is then transported eastwards back onto the beach.

There have been considerable changes to the Sandend Burn Sand Sheet (Figure 13). The western third of the sand sheet has been stabilised and topographically altered. This land-raising also extends across the former expansive dune slack area now occupied by the 14th fairway. This not only has destroyed/removed the deflation surface (and its habitats) but also sealed off much of the blowout corridors that linked the deflation surface to the higher dunes. This 'seals off' many of the source areas for the Sandend Burn sand sheet, which will reduce its dynamism and scientific interest. Areas of marram sprigging extend over parts of the first dune ridge.

The extent of bare sand within the Sandend Burn sand sheet in 2006 was 22,000 m^2 and dune slack was 12,900 m^2. By 2013 this had reduced to 2,100 m^2 and 5,700 m^2, respectively. In percentage terms 9.5% of the bare sand remains and 44% dune slack habitat remains, following the construction of the golf course.

Beyond the stabilised and land-raised areas there remain smaller areas of scientific interest, south of the Sandend Burn. These include highly dynamic blow outs corridors cutting through more mature mobile dune, cascading dunes inundating semi-fixed dune and improved grassland beyond. The adjacent stabilised areas influence the functionality of the remaining sand sheet. The lack of human interference, which greatly enhanced the scientific interest of these features, has been reduced. As a result the Sandend Burn sand sheet has been partitioned, the stabilised areas along with those which have been buried under fairways, now offer little or no scientific interest. Areas adjacent to those stabilised will show more limited dynamism as a result; with an associated reduction in scientific interest. Landforms and habitats furthest away from the stabilisation will (in large part) maintain their dynamism and as a result scientific interest.

In a similar way to other parts of the site, the scientific interests are more than the sum of the constituent parts. What made Menie Links such an important site was the juxtaposition and functionality of landforms, processes and habitats. So, as with the Menie sand sheet, the destruction of the deflation surface adjacent to the Sandend Burn sand sheet, removes the other part of the assemblage which is integral to the past and ongoing functioning and scientific interests of these features.

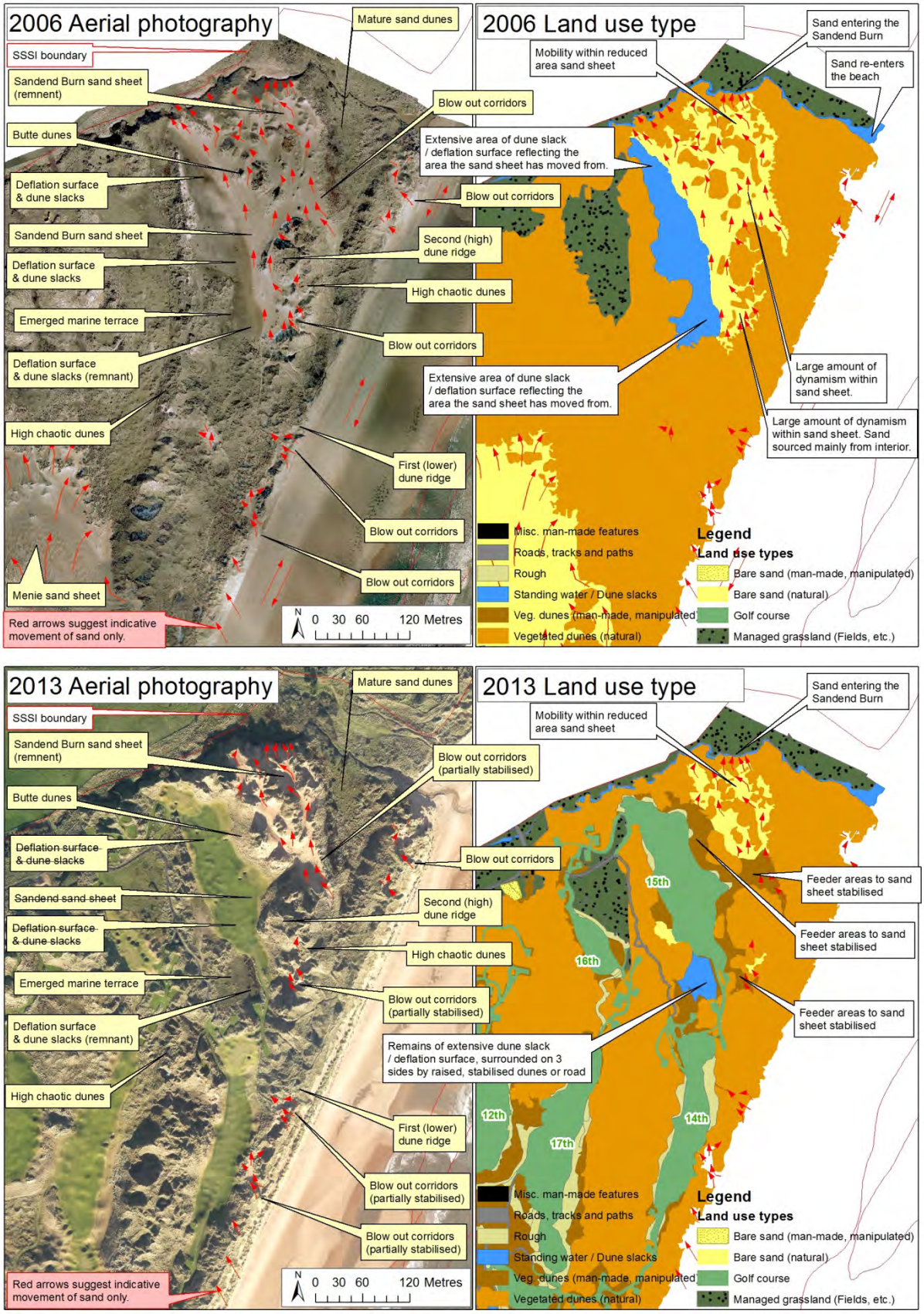


Figure 13 Before and after aerial photography and land use change maps at Sandend Burn sand sheet annotated with key geomorphological interests and the final course layout.

Sandend burn sand sheet (incl area to south) 15th hole	
Before construction (April 2011) (arrows identify similar points)	After construction (June 2013) (arrows identify similar points)
 Source area for Sandend burn sand sheet, pictured from high mobile dunes looking northwards. Expansive dynamic areas contributing and transiting sediment into interior of the sand sheet. Deflation surface to west/left (arrow), with seasonal water. Erosion accessing high dunes in distance, supplying sands (arrow). This picture includes source, transit and depositional areas and resultant habitats – all of considerable scientific interest.	 Deflation surface in bloom (arrow) reflecting seasonality. Land-raising within the vicinity of the path, tee, fairway, rough and green. Former active areas now all stabilised, including high dunes to the right far distance (arrow).
 Sandend burn sand sheet blow out corridors contributing sediment into the dunes and sheet beyond. High dune (arrowed) also providing sediment. Dune slack extends along valley floor, demonstrating systematic movement of sand sheet northwards.	 15th fairway and green laid on land-raised surface. Adjacent areas of bare and mobile dune now stabilised under sprigged marram or short grasses. No active processes or geomorphological interest within managed areas.

Before construction (April 2011) (arrows identify similar points)	After construction (June 2013) (arrows identify similar points)
 The edge of the deflation surface (with vehicle tracking) reflecting the water table influence on wind erosion. Natural transition between slacks and adjacent dunes.	 The dune slack has been buried (in very large part) with complete loss of geomorphological interest within the foot print of the fairway. Stabilised areas beyond are also reduced in geomorphological interest.
 The deflation surface, dune slack and seasonal water have natural transitions and reflect ground water conditions and exchange of sediments across wide areas.	 Whilst dune slack species remain (to the right of this photo) they are now surrounded on 3 sides by tarmac road, raised fairway and stabilised / planted dunes, which all influence the supporting processes.
 Northwards of the Sandend Burn sand sheet, the dunes show little sign of human interference. Whilst the dune cordon narrows here it widens again north of Drum Links.	  Unaffected areas of the Sandend Burn sand sheet remain geomorphological interesting, however the interference in feeder areas reduces the dynamism and interest within these areas.

Drums and Foveran Links

For the avoidance of doubt the earth science designated features (nationally significant landforms and processes) are located within the northern half of Foveran Links and wholly within the GCR site (Figure 1), the remaining southern half of Foveran Links and Drums links contain less interesting dunes from a geomorphological perspective and are designated for their ecology alone.

Drums Links and Foveran links extend northward from the Sandend burn, and therefore lie beyond the golf course development (Figure 14). The features were described by Hansom (2007) whose description is repeated here.

'*Foveran Links consists of a series of sub-parallel lines of massive, 10-12m high dunes with a well-developed wet slack between the broad coastal dune ridge and the sand-covered Holocene cliff-line which lies a few hundred metres inland. Low cliff-lines cut into glacial or glacifluvial deposits and emerged beach deposits are conspicuous features underlying much of Foveran Links and Drums Links. The beach comprises a series of shore-parallel intertidal bars with intervening runnels whose northward migration has deflected small streams in this direction. At the Ythan exit the northward drift has resulted in accretion, so that the beach is now 250m wide and backed by actively accreting embryo dunes (MacTaggart 1998) that were still present in 2006. In contrast to this essentially accreting area close to the Ythan exit, to the south the Foveran and Drums coastal edge is characterised by a foredune ridge which becomes discontinuous and severely undercut. High dune faces are produced along the eroded seaward edges and extensive unvegetated sand aprons have accumulated between and behind the eroding dunes, suggesting that whilst some sediment drift north occurs, there is also a significant movement of sand landwards. From photographic evidence in MacTaggart (1998) and confirmed in 2006, the incidence of frontal erosion of both old and young dunes seems to increase southwards from the Ythan exit to reach a maximum mid-way between the Ythan and the Sandend Burn where the Menie dunes begin. Along much of the Foveran and Drums backshore, several wartime tank traps dating from the 1940s are partially exposed by erosion of the coastal edge. Since these traps have been buried by sand accumulation prior to present exhumation, at least one cycle of accretion followed by erosion has occurred. Recent additions to these wartime concrete tank blocks have been placed across the entrances to blow-outs in the coastal edge in a partially successful attempt to stabilise the dunes and reduce sand blow over the inland dune areas and sand sheet.*

Inland, several sand dune ridges run north-south at an angle that is oblique to the north-east - south-west alignment of the present coastal edge, suggesting wind blow forcing sand dune orientation along this trend. Progradation in the north-east is also suggested by the occurrence of a zone of stable dunes up to 25m high fronted by more active dunes that reach 21m in height. The most distinctive landform at Foveran is an extensive area of bare sand or sand sheet which extends 0.5km inland from the northernmost 2km of the fragmented foredune ridge (Figure 3). Ritchie et al. (1978) considered this area to be comparable to the more extensive bare sand area at South Forvie, its scale and height being partly determined by undulations in the underlying glacigenic landforms and emerged marine gravel ridges. However, the area of bare sand remains highly dynamic, and sand passing through breaches in the foredune ridge continues to migrate upslope in a northerly and north-westerly direction.

In addition to the tank traps exhumed along the coastal edge, the central sand wave at Foveran Links has been subject to human modification by excavation and military use in the past, with a decaying

tubular steel loading ramp now exposed in the centre of the sand wave and concrete pillboxes nearby.

As at South Forvie, both the emerged gravel ridges and water table at Foveran and Drums Links act as a local base level for large deflation areas (centred on NK 0052337 and NK 003234). The Drums dune system in the south is now largely stable with extensive vegetation cover, a colonisation process predicted in 1978 by Ritchie et al. (1978) as the then sand cover thinned with deflation following the northward transit of the sand sheet (Figure 5). Together, Drums and Foveran Links form a sand unit that is now narrow and very stable in the south at Drums but increases in width and activity to the north at Foveran Links where its northward extension is truncated by the Ythan. Given the lack of inland penetration of dune sand at Drums, it is possible that the two systems have held a broadly similar pattern for some time.' (SNH, 2007)

Figure 14 Annotated aerial image of Foveran and Drums Links (2011)

SNH (2007)	(June 2013)
Foveran Links	Foveran Links
 The sand sheet at Foveran remains dynamic and extensive in spite of human modification.	 The sand sheet at Foveran shows comparable levels of instability and the scientific interests identified in 2007, remain present in 2013.
 View south from the edge of the Foveran sand sheet to the deflation areas of Drums Links. These are now colonized by dune and damp slack vegetation.	 View north from over the vegetated deflation surface looking towards the Foveran sand in the distance. These damp slacks are more advanced than the younger dune slacks adjacent to the Menie and Sandend Burn sand sheets.

Drums Links

Whilst Drums Links are included alongside Foveran Links within the Hansom's description above, the dunes are far narrower than adjacent dune systems north and south. The vegetated part of the designated dunes is less than 28m wide at its narrowest. There is significant modification landwards and out with the SSSI boundary for much of the Drums section. During the initial site designation it is understandable why Drums Links were included; providing a link between two expansive and scientifically interesting sites. This section of dunes was designated for its ecological interests only and there remain no nationally significant interests here for geomorphology.

Implications of these change on the geomorphology

During the Public Local Inquiry both the Applicant and SNH anticipated that if the proposed golf course was constructed then the Menie Sands Sheet would be stabilised and the Sandend Burn Sand Sheet would be partially stabilised. The implications of this were also acknowledged by all parties, in that this would remove much of the scientific interest of the Menie Links section of Foveran Links SSSI. The highly dynamic and systematic movement of the sand sheet, with the linked creation of new young dune slack was expected to be lost in very large part, and it has been corroborated by this analysis.

Appraisal of geomorphological interests

SSSI Citation (Geological interests):

'*Foveran Links is an important part of the Sands of Forvie coastal area to which it is closely linked by a variety of environmental processes. Foveran Links, together with South Forvie, is a type example of what may be described as a normal sand dune system with a dynamic interchange of material between the frontal dunes and the extensive sand beach and spit complex at the mouth of the River Ythan. The site is of exceptional importance for the study of a wide variety of coastal landforms and processes and its value is enhanced by the availability of extensive research results in other disciplines which provide much additional and complementary evidence relevant to solving a broad range of geomorphological problems*.' (Foveran Links SSSI Citation)

SSSI Criteria

The guidance on denotification of SSSIs states that where, '(d) the natural feature has declined, lost or damaged beyond reasonable expectations of recovery' … and … 'if … there are no new qualifying interests on that land, you might decide to denotify the SSSI in whole or part.'

Although the Menie Links section of the SSSI is designated for its ecology alone, the following section considers if there are sufficient geomorphological features (landforms or processes) following the construction of the golf course to support an earth science SSSI designation. This ensures that if landforms or processes were enhanced by or survived alongside the construction of the course then they could be considered for designation.

Landform changes:

Menie sand sheet and surroundings

The remarkable interests within this part of the SSSI were the scale and extent of unhindered natural processes and the full range of landforms and habitats that were created and maintained as a result. These features individually and as a whole were at least 'exceptional features' or of 'international importance' (ref: JNCC Guidance on earth science features). Whilst the geomorphological interests extend into the connections and interrelationship between processes and landforms within and beyond the sand sheet, the scale of the loss of interests is most succinctly described by two statistics: Less than 1% of the Menie sand sheet remains and almost 60% of the dune slack immediately adjacent to the Menie sand sheet has also been lost during the construction of the golf course. The destruction of the geomorphological interests of the Menie sand sheet is complete.

Menie sand sheet and surrounding links: Following the construction of the golf course, no qualifying geomorphological processes or features worthy of SSSI status remain in this part of the designated site.

Between Menie sand sheet and the Sandend Burn sand sheet.

North of the Menie sand sheet, mature dunes extended again with little human interference, following the construction of the golf course the 11th, 12th and 17th holes now subdivide these expansive areas along with considerable land raising and wider topographic adjustment.

Between Menie Links and Sandend Burn sand sheet: Following the construction of the golf course, no qualifying geomorphological features worthy of SSSI status remain in this part of the designated site.

Sandend Burn Sand Sheet & surroundings

Within the Sandend Burn sand sheet 90% of the bare sand area has been lost under golf course or stabilised dunes. 56% of the adjacent dune slack area has also been lost during the construction of the 15th hole. What features remain are largely fragmentary, more isolated and of diminished geomorphological interest as a result. Given the stabilisation of areas immediately adjacent to the partial remains the feeder areas are less natural than before, which is likely to alter the onward development of these areas.

Sandend Burn sand sheet: Following the construction of the golf course, the remaining area fails to meet the standard for SSSI Status, and there are no new geomorphological features which are worthy of SSSI status.

Drums Links

Whilst there have been little change in Drums Links and they lie outwith the perimeter of the golf course development, they were notified for their ecological interests only. As noted earlier they are very narrow and provided a linking role between two expansive and scientifically interesting sites. There are interesting features within this section, although none of these features (in isolation) meet the SSSI criteria.

Drums Links: There are insufficient geomorphological features to merit designation for earth science interest.

Foveran Links

The earth science designated features (nationally significant landforms and processes) are located within the northern half of Foveran Links and wholly within the GCR site (Figure 1), the remaining southern half of Foveran Links and Drums links contain less interesting dunes from a geomorphological perspective and are designated for their ecology alone. As noted above, Foveran Links has two large areas of bare sand which contain some of the similar features to Menie Links in form and process, but differ in the level of human interference and amount of young dune slacks being formed. A comparison between Figure 2 and Figure 14 shows the changing extent of bare sand between 1999 and 2011, nevertheless sufficient geomorphological interests remain to support the GCR and SSSI. Beyond these limited changes Hansom's (2007) description remains valid and the scientific interests remain.

Foveran Links: The scientific interests remain, which meet the SSSI and GCR site selection criteria within the GCR section of the designated site (Figure 1).

Process changes:

The aeolian processes (wind-blown) have been almost entirely sterilised within the stabilised areas, as although the wind blows, the dynamic interaction with landforms has ceased. As a result the unique characteristic has been lost within and surrounding the footprint of the golf course, and therefore these areas no longer retain sufficient national-level scientific interest.

Whilst not corroborated through field measurement there are likely to be ground water / hydrological changes as a result of the construction and operation of the golf course. The introduction of drains, irrigation and fertiliser use will have a direct and indirect effect on the landforms, processes and ecological interests which remain. Natural sand dunes are nutrient scarce habitats, which can be contrasted by the lush tees, fairways and greens which now cover them.

The functionality (links between features and their interaction) of landforms and habitats is a key consideration in the scientific interests of the site, and within and surrounding the Menie Links and Sandend burn sand sheet these were some of the best examples in the United Kingdom. Whilst non-specialists may claim some of the landforms remain; the near complete cessation of active processes renders this site sterile and moribund.

Recommendation

Within Menie Links the natural features have been damaged by the golf course, beyond reasonable expectation of recovery. There are no (geomorphological) special scientific interests to the south of Forvie GCR site, only partial fragments exist within the Sandend Burn sand sheet. There are no new nationally significant geomorphological interests in the SSSI south of Forvie GCR site. Within the vicinity of the golf course the geomorphological processes and features which supported the designated ecological interests are no longer operational or present. Given the absence of the supporting geomorphological processes, this analysis suggests that the ecological designation is untenable within the foot print of the Golf Course. The earth science interests remain within the GCR site (Figure 15).

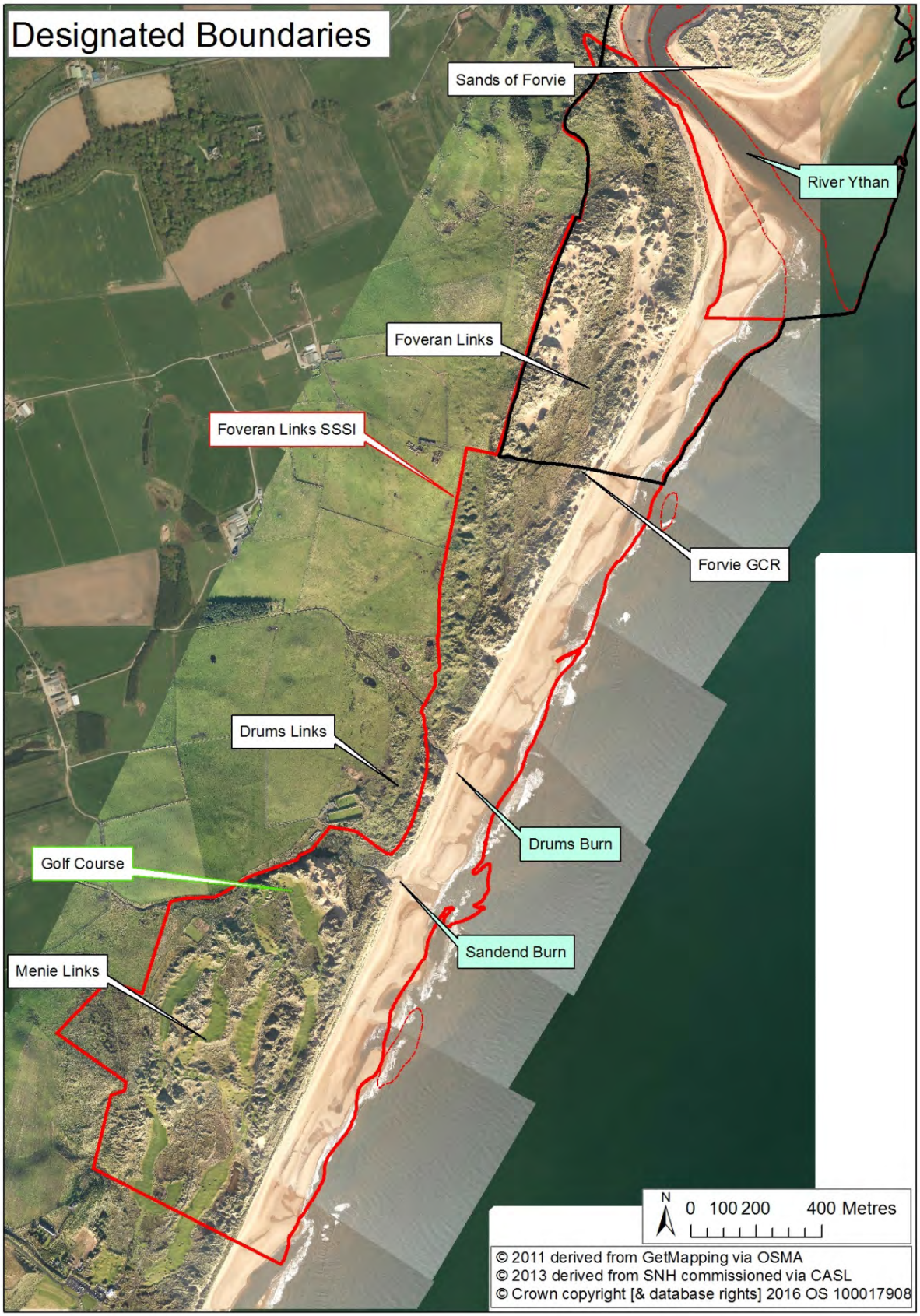


Figure 15 Proposed new southern boundary of the SSSI. This is based only on geomorphological interests and should be considered alongside other recommendations from Ecological Advisor and Operations Staff.

Reference list

SNH (2007) Foveran Links SSSI review of scientific interests ….. (http://www.snh.gov.uk/publications-data-and-research/publications/search-the-catalogue/publication-detail/?id=1323)

Rennie & Hansom (2008) Analysis of historical aerial photography of Aberdeen Bay and Old Statistical Account for Scotland 1791. SNH Production (SNH#11) for TIGLS PLI.

Appendix 1 – Methodology to establish land use change at Menie Links.

Methodology for 63462 – Analysis of land use change at Menie and Foveran Links SSSI

Document History

Revision	Revision Date	Summary of changes
0.1	06/05/2014	First draft of document

Approvals

Name	Title	Date of Issue	Version

Distribution

Name	Organisation	Date of Issue	Version
Jake Hanson	SNH		
Alistair Rennie	SNH		
Eleanor Charman	SNH		
Annelie Mattisson	SNH		

Objectives/Aims

The main aim of the project was to map the change in land use types at Menie/Foveran Links as a result of the creating of Trump International Golf Links Scotland's championship golf course. By manually digitising several predetermined land use types, it would eventually be possible to calculate the change in natural land use types to land use types that show some kind of adjustment or manipulation.

Job request

"Foveran Links SSSI - Undertake an analysis of land use change at Menie Links within Foveran Links SSSI. Datasets available include (1) pre-development orthophoto (NAS: available on request), (2) Getmapping Aps (geostore) and (3) post-development orthophoto (2013) (NAS: available on request). Work would include, QA of 2013 orthophoto mosaic, digitisation of 'new' features (paths, golf course etc), and quantification of areas of undisturbed and disturbed areas (m2). We would also want the digitisation QA'ed and I'm also happy to liaise during the digitisation if there is any doubt. Many thanks, Alistair"

Methodology

Datasets

The location of the ArcMap document used for the project is in K:\PPT\Areas\Ecosystems and Biodiversity\63462 - Analysis of land use change at Menie and Foveran Links SSSI - 05 December 2013\ArcGIS. This document should hold links to the layers noted below.

Three sets of aerial photography were available for the period over which the change took place:

Name	Date	Owner	Sourced via…
T1	2006	TIGLS	Provided by TIGLS to support planning application and PLI
T2	2011	GetMapping	Supplied via One Scotland Mapping agreement
T3	2013	SNH	Commissioned by SNH, Flown by Caledonian Air Surveys.

The photography for time period 1 (T1) (balmedieT1.tif), used as the control, was taken prior to any development of the site and was taken in the year 2006

The photograph for time period 2 (T2) was taken during the construction of the golf course, and exemplifies the areas that were altered very clearly. This photography was provided by Getmapping Plc. and was flown in 2011.

The photography for time period 3 (T3) was taken in the latter stages of construction, in November 2013, and is named 'Foveran Links 20cm mosaicT3.tif'

The workspace was FoveranData.gdb, within the Data folder of the project.

Within the Geodatabase, T1, T2 and T3 relate to the respective images. (T1 being the first, 3 being the latest).

Method

Following the advice of Margareta (2007) "Colour infrared aerial photography as a tool for vegetation mapping and change detection in environmental studies of Nordic ecosystems: a review", it was decided that the best method to accurately digitise the land use was to use the SSSI boundary polygon as the bounding polygon for the study, and split this into land use sections. Although not all of the SSSI is covered by the imagery, it provides a good starting point from which one can dissect the relevant land use types. Once I had digitised T1, I cut off the area of polygon to the north of the available imagery, and to the east of the site (the intertidal area), based upon the extent of the dune system

I set up a domain on the file .gdb called LANDUSETYPES, into which I added the land use types relevant to the study: Bare Sand, Vegetated dunes, Emerged Marine Terraces, Paths, Roads, Buildings, Car parks, Managed Grassland, Golf course (Fairways, tees, greens, paths, practise areas), Other Man-Made Feature, Loch Island, Standing Water / Dune Slacks. This was so I could select them from a dropdown menu in the field within arcmap.

Copying the polygon for Foveran Links SSSI, I added a field to store the land use types. This would be the feature class for T1. Using the cut tool, I split the polygon based upon the differences in land cover I could see from the imagery, and tagged it with the relevant label from the dropdown in the attribute table. The digitising was done at 1:500, as it allowed me a decent level of accuracy, and at higher scales, it became more difficult to distinguish edges. Unfortunately this imagery wasn't as good as the imagery from T2 and T3, which has caused some differences in land use. Nevertheless this is over small areas (generally patches of dune within areas of bare sand) and won't make much difference to the overall totals.

For the Getmapping imagery, I copied the feature class for T1 and named it T2. I cut the existing polygons to match the new imagery, using the Getmapping (2011) imagery as a guide. This meant that where boundaries had remained constant, there wasn't human error affecting the area figures, which may have been the case had I not used this method. Unfortunately, the imagery from T1 was not orthorectified to the same DTM as the imagery from the other 2 time periods, meaning that although I had attempted to re-orthorectify the imagery to match T2, there were issues at the boundaries of land use areas. It seemed more logical to accurately map the new imagery than assume that the boundaries were in the same place, so there are cases where Vegetated Dune (natural) became Bare Sand (natural) and vice versa (~3m error). When I intersected the data at the end, it was apparent that the error because of this was in the region of 3-5% of the total land area, which is thought to be an acceptable value.

In T2, the distinction between roads/tracks/paths and bare manipulated sand wasn't always clear, but where there were obvious tracks in the sand, I classed this as a road/track. Nevertheless, these may have changed day-to-day in the large sandy areas, particularly as areas became filled in with manipulated dune or golf course.

During the digitising of the T2 imagery, it became clear that some of the categories were not really useful or suitable for the analysis. The categories were changed to the below, and these remained for the rest of the project.

Bare sand (manipulated)
Bare sand (natural)
Golf course
Managed grassland
Other man-made feature
Roads, tracks and paths
Rough
Standing water / Dune slacks
Vegetated dunes (manipulated)
Vegetated dunes (natural)

*Rough being the Rough at the edge of the courses. Other man made features are generally enclosures, and these moved or were removed during the analysis, mainly in managed grassland areas. Where they were removed and the land looked natural underneath, the land use was classed as natural.

The T3 imagery was provided by Caledonian Air Surveys, and was generally of good quality. As they had used OS Panorama, which is the OpenData 50m DTM, whereas Getmapping use a much higher resolution DTM, there were some differences between the getmapping and CAS orthorectification, particularly in the vegetated dunes where there was quite a lot of elevation change. I emailed Caledonian Air Surveys to get it re-orthorectified using Nextmap 5m DTM and Getmapping imagery, which we supplied to them under contract.

The T3 imagery was relatively straightforward to digitise, but brought up a couple of issues in the other imagery, particularly relating to standing water/dune slacks. As a result, I increased the area classed as dune slack in the T1 and T2 imagery.

Outputs

Once complete, I intersected and dissolved the 3 datasets on the landusetypes field, so that change from one category to another could be viewed more clearly, and so that the values of change could be created. (..\Outputs\Allyears_landuse.shp)

Alistair and I calculated the percentage cover of each landuse type in each timeframe, and then calculated the overall percentage of natural and manipulated. (manipulated shown in red in above table). This gave the values in

K:\PPT\Areas\Ecosystems and Biodiversity\63462 - Analysis of land use change at Menie and Foveran Links SSSI - 05 December 2013\Outputs \63462 - Analysis of change at Foveran Links - Spreadsheet - 5 May 2014.xls - Breakdown of areas (total) worksheet.

Alistair then requested that the areas that had been untouched outside of the development area be removed and stats recreated. (..\Outputs\Allyears_landuse_clipped.shp) (Breakdown(within dev area) worksheet).

I also created a layer file with T1,T2,T3 in, and within ..\Outputs\T1, T2 and T3, created subsets of each dataset based on whether or not the land use was natural.

Scottish Natural Heritage
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All of nature for all of Scotland
Nàdar air fad airson Alba air fad

Foveran Links SSSI
NCA Review – Sand dune

Version	Date	Comments
V1.0	10.2.16	Stewart Angus
V1.1	10.2.16	Stewart Angus following discussion with Alistair Rennie and initial feedback from David Bale
V1.2	17.2.16	Comments from Sue Lawrence and Mike Smedley added, plus SA comments on these as v1.2. New document created for v2
V20		New version accommodating comments in 1.2
V2.1	24.4.2017	Comments from Neale Taylor
V2.2	10.5.2017	Amendments by Stewart Angus
	31.8.17	Final version by Stewart Angus
V2.6	25.1.18	Minor edits to final version by Stewart Angus

Professor Stewart Angus

Doc ID:

Introduction

This review of the biological interest of Foveran Links SSSI has been conducted at the request of the Tayside & Grampian team within Scottish Natural Heritage. Though the geomorphological review was employed in establishing the context of changes evident on the site, as were the illustrations and statistics within that report, the evaluation has been conducted almost entirely from an ecological viewpoint: the geomorphology component has been directly included within the evaluation only where it is an inherent element of the ecological interest.

The Sand Dune appraisal relies very heavily on the Geomorphology review conducted by Dr Alistair Rennie and should be considered in conjunction with it. Any ecological interest of sand dune is always very closely linked to geomorphological processes, but the relationship is particularly strong in respect of the Sand dune SSSI feature at Foveran Links. This review is also strongly dependent on the excellent GIS visualisations included in the geomorphological report. General details relating to the wider SSSI are fully described in the Geomorphology report

This site was the subject of a Public Local Inquiry, which resulted in the development proceeding. Though the SNH case in the PLI has been employed here, there is an additional and separate evaluation against the SSSI selection criteria. Text given in brown is cited verbatim from PLI and SSSI designation documents and may contain coded references to related documents (e.g. T50 is a PLI document – not relevant to this report but referred to in cited text). All Scottish sand dune vegetation was the subject of a national survey, the Sand Dune Vegetation of Scotland (SDVSS)(Dargie 2000). The SDVSS survey of the whole of Foveran SSSI was conducted in July 1999 was no longer valid, and a new survey was conducted by the same surveyor in 2006, on behalf of the developer. This was subsequently digitised and is used here in respect of the development site, but the 1999 survey has been relied on for the remainder of the site as no more recent source is available. Despite the same individual conducting both surveys, they are not directly comparable, as the later survey, confined to the development site, identified rather more dune slack habitat, particularly young dune slack SD13.

The term ‘Foveran Links’ as used here refers to that section of coast between Drum Links and the River Ythan. Where the SSSI of that name is referred to, the term ‘Foveran Links SSSI’ is used. ‘Development site’ refers to that part of the SSSI south of the Sandend Burn, except for a very small section just south of the Sandend Burn that has not been directly impacted by Golf course construction. Occasionally the term ‘Development site’ additionally includes areas within the golf course footprint that are outside the SSSI, as far south as the Blairton Burn, but not in any way that affects the conclusions of this review.

Initial work on the vegetation overlays revealed a significant projection problem with the position of the NVC dataset - it was some 80m SW of where it should have been. This was solved by a coalition of David Hodgson and Alistair Rennie, who ‘shifted’ the NVC dataset to within around 2m of where it should have been. This corrected NVC dataset is TIGLS_2006_NVCreprojected2016, created on 21.1.16.

Full details of datasets employed are supplied within the Appendices to the Geomorphology Review. All maps are aligned so that North is at the top. All ground photographs are © Stewart Angus/Scottish Natural Heritage.

The relevant part of the SSSI citation (accessed via Sitelink 26.6.13) is:

> *Foveran Links contains extensive areas of mobile foreshore and sand dunes as well as fixed dunes, dune pasture, marshes and heath. The relationship between various plant communities and sand stability is clearly shown and the continuing movement of sand masses allow direct observation of these interactions.*
>
> *Although closely linked and similar to the Sands of Forvie and Ythan Estuary NNR to the north, the site does contain several species and communities which are absent from or less well represented in the NNR. The vegetation of the dune hollows and pasture, some of which are grazed, are especially interesting.*

During the PLI, SNH made the case that the following habitats would be adversely affected by the construction of the golf course (Angus, 2008):

All four of those listed below occur in the SSSI and in the area to the south within the development proposal, though the dune heath is highly localised within the development section of the SSSI, being much more frequent in the section south of the SSSI boundary (T50).

1 Mobile dune. This includes the bare sand and all the marram-dominated dune. The marram dune (but not the bare sand) corresponds to the Annex I habitat 'Shifting dunes along the shoreline with Ammophila arenaria' (marram)

2 Fixed acid dune. This corresponds to the Annex I habitat 'Fixed dunes with herbaceous vegetation ("grey dunes")'.

3 Dune heath. In the development site this corresponds to Annex I habitat 'Decalcified fixed dunes with Empetrum nigrum' (crowberry). Other heaths occur elsewhere.

4 Dune slacks. In the development site this corresponds to Annex I habitat 'Humid dune slacks'.

SNH also made the case that the bare sand within the development area (largely within the SSSI) was of critical importance to habitat functionality.

Golf hole numbers are frequently referred to in the text. The layout of the golf course is shown in Fig. 1.

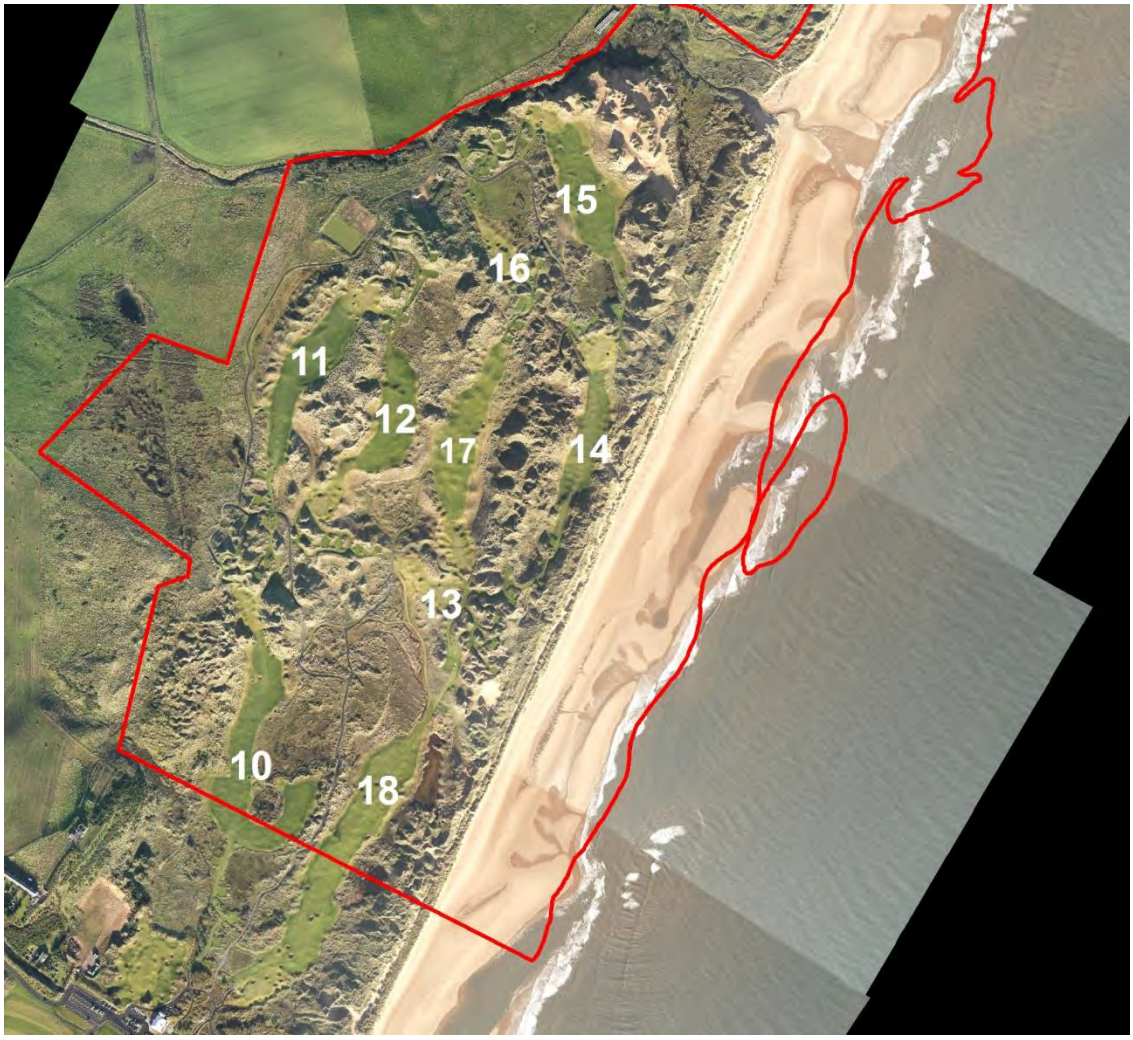

Fig. 1. Hole numbers on golf course, using 5 CASL (Caledonian Air Surveys Ltd) RGB composite 2013 as backdrop. SSSI boundary shown in red.

The impact of the Golf Course on the habitats in the SSSI

The dune habitats including Annex I habitats are examined in turn, beginning with bare sand.

Bare sand and Dune Slacks

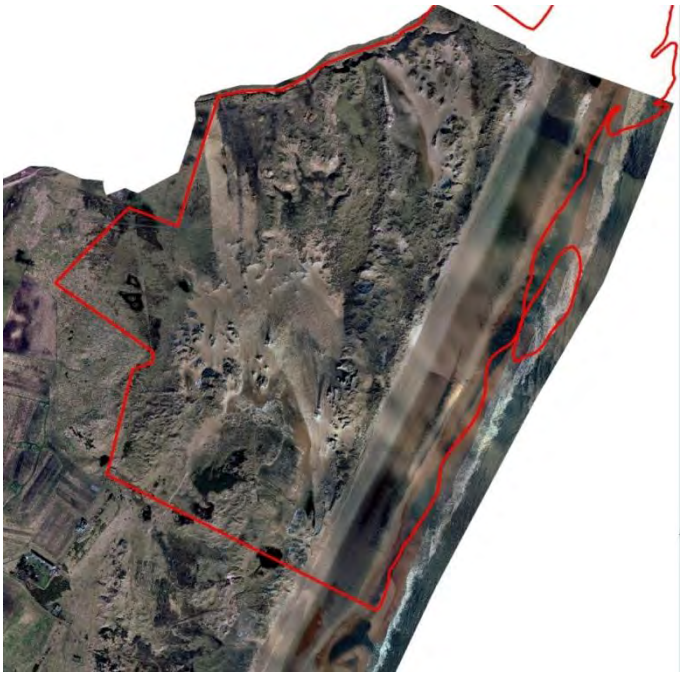

Fig. 2. 2006 TIGLS RGB composite, showing outline of SSSI and natural state of dunes prior to construction. SSSI boundary shown in red. Photography © TIGLS.

The functionality of very important aspects of the dune system are heavily and in some cases entirely dependent on the movement of bare sand. The main ecological significance of the bare sand was its mobility. As it progressed NE, it moved away from the trailing edge, leaving exposed, wet sand (at the level of the water table, as only dry sand will blow in most wind conditions), and as it moved north, it would be deposited, advancing the position of the leading edge. In the newly exposed wet area, young dune slack SD13 was formed, a process illustrated in Figs 10-14. This would obviously age and become SD16 mature dune slack, so newly exposed areas were regularly required to maintain the SD13. Obviously this process must be continuous to allow for new surfaces as the others age. Though boundaries of the bare sand areas as shown in Dargie's 2006 map are given (Figs 3, 5-8), it must be emphasised that these would always have been mobile – i.e. by the time of the course construction or photography, their location would have moved from the 2006 outline naturally.

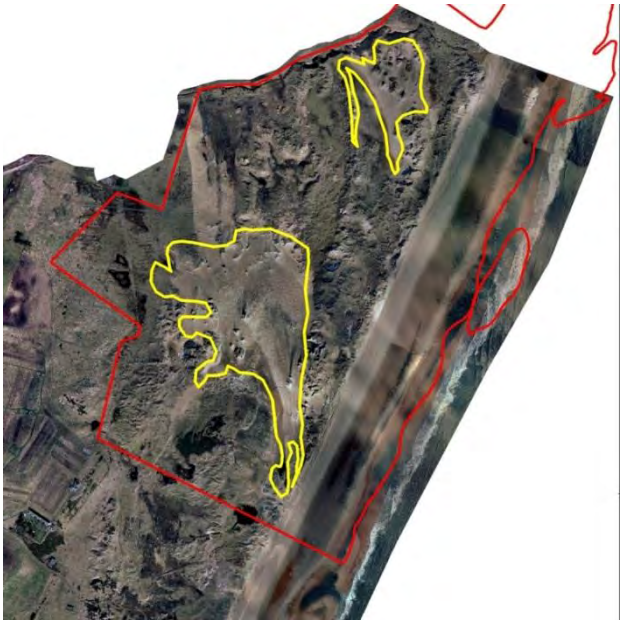

Fig. 3. 2006 TIGLS RGB composite, showing outline of SSSI and natural state of dunes prior to construction. Area classified by TIGLS surveyor Tom Dargie as bare sand outlined in yellow. SSSI boundary shown in red. Photography and polygons © TIGLS

Fig. 4. Getmapping aerial image 2011 showing course under construction and scale of sand redistribution. SSSI boundary shown in red. © Getmapping plc

Fig. 5. Getmapping aerial image 2011 showing course under construction and scale of sand redistribution. Former (natural) areas of bare sand indicated in yellow. SSSI boundary shown in red. Photography © Getmapping plc, polygons © TIGLS.

Fig. 6 CASL (Caledonian Air Surveys Ltd) RGB composite 2013 post-construction showing the two areas of 2006 bare sand in yellow. SSSI boundary shown in red. Photography © SNH , licensed under the Open Government Licence, polygon data © TIGLS.

Fig. 7. CASL RGB composite 2013 post-construction with outline overlay of the northern areas of 2006 bare sand (Sandend). © SNH , licensed under the Open Government Licence, polygon © TIGLS

Fig. 8. CASL RGB composite 2013 post-construction with outline overlay of the southern areas of 2006 bare sand (Menie). © SNH , licensed under the Open Government Licence, polygon © TIGLS

A small amount of bare sand remains within the former northern section, Sandend, with an area to the north of this, possibly reflecting northern movement since 2006 (Fig.7). These northern sections are a mix of dune and bare sand and do not begin to match the large expanses of bare sand that once occupied this general area. Much of the area of this former section of bare sand is occupied by the 15th hole (Fig. 9).

Fig. 9. NE margin of 15th hole, showing sprigs of planted marram and abrupt boundary with fairway and green.

Stabilisation of the former sand sheets ranges from full conversion to fairway, to bare sand with sprigs of marram, often with some sort of sprayed stabilising agent that forms a distinct crust on the surface (Fig. 22).

The southern section of bare sand (Menie sand sheet) has been entirely stabilised and thus destroyed in terms of its geomorphological interest (Fig. 8). The northern (Sandend) sheet is intact over its northern extent (Figs 7, 28), but the stabilisation of its trailing edge has removed a significant aspect of its functionality. Nevertheless, the northern section of the Sandend sheet retains a natural appearance and retains its interest at a very local level (i.e. without considering context). The conversion of the section of the Sandend sheet within the course layout has been extreme (see pp. 29-30 of geomorphology report) with the floor of the former slack raised now beyond the water table.

Fig. 10. 2011 GetMapping aerial imagery of course under construction overlain with bare sand (pale yellow), young slack SD13 (pale blue) and mature slack SD16 (pink), clearly illustrating northward progression of the sand and the development of slack habitat in its wake. © Getmapping plc, vegetation polygons © TIGLS

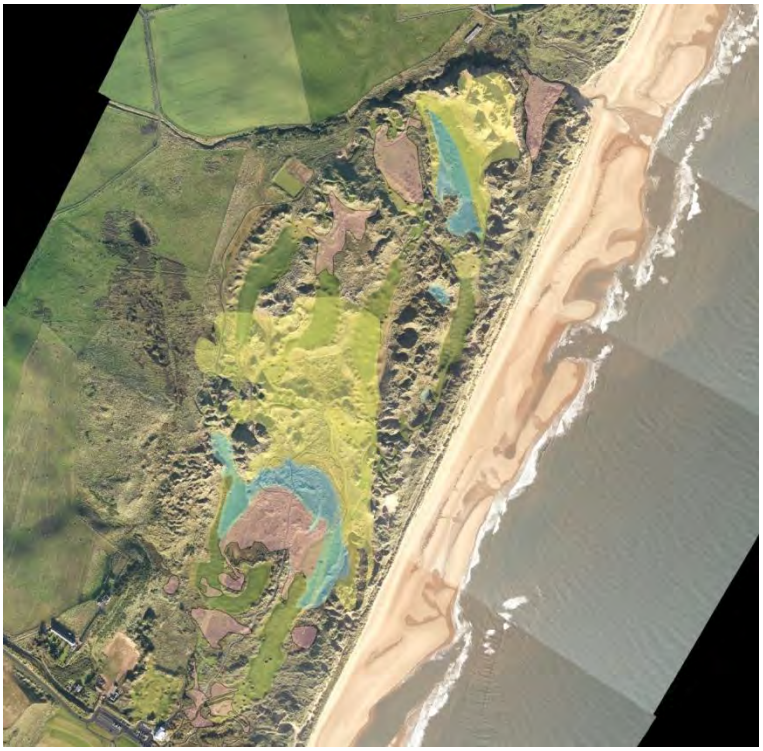

Fig. 11. Post-construction aerial from 2013 (CASL composite) overlain with former distribution of bare sand (pale yellow), young slack SD13 (pale blue) and mature slack SD16 (pink), illustrating scale of impact on dune dynamism. © SNH , licensed under the Open Government Licence, vegetation polygons © TIGLS.

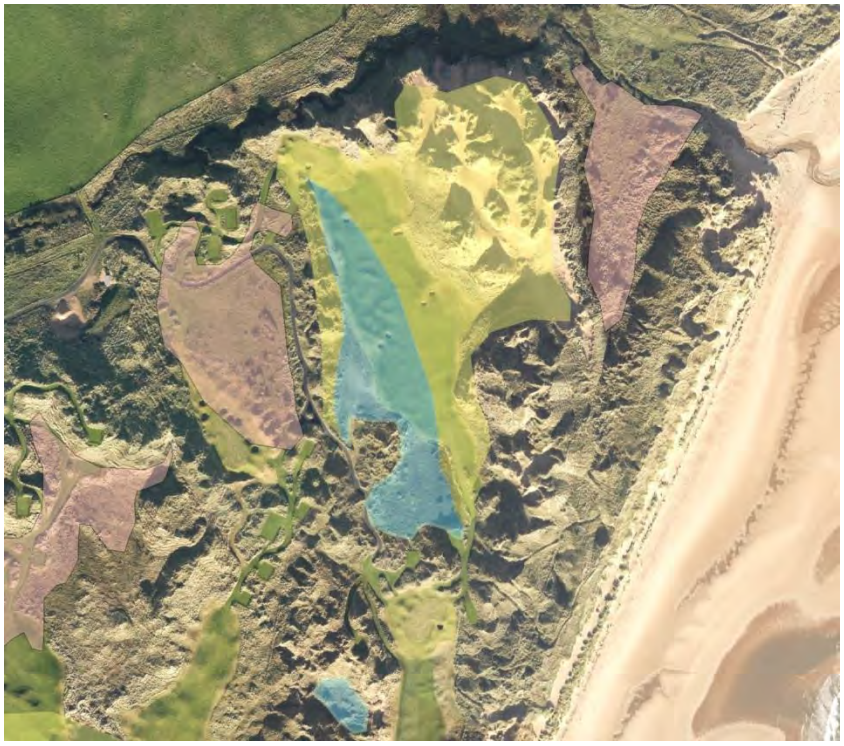

Fig. 12. Post-construction aerial from 2013 (CASL composite) overlain with former distribution of bare sand (pale yellow), young slack SD13 (pale blue) and mature slack SD16 and dune heath H11 (pink), illustrating scale of impact on northern dune area. © SNH , licensed under the Open Government Licence, vegetation polygons © TIGLS

Fig. 13. Post-construction aerial from 2013 (CASL composite) showing detail of the current (or near-current) situation of northern dune area without any overlay. © SNH , licensed under the Open Government Licence

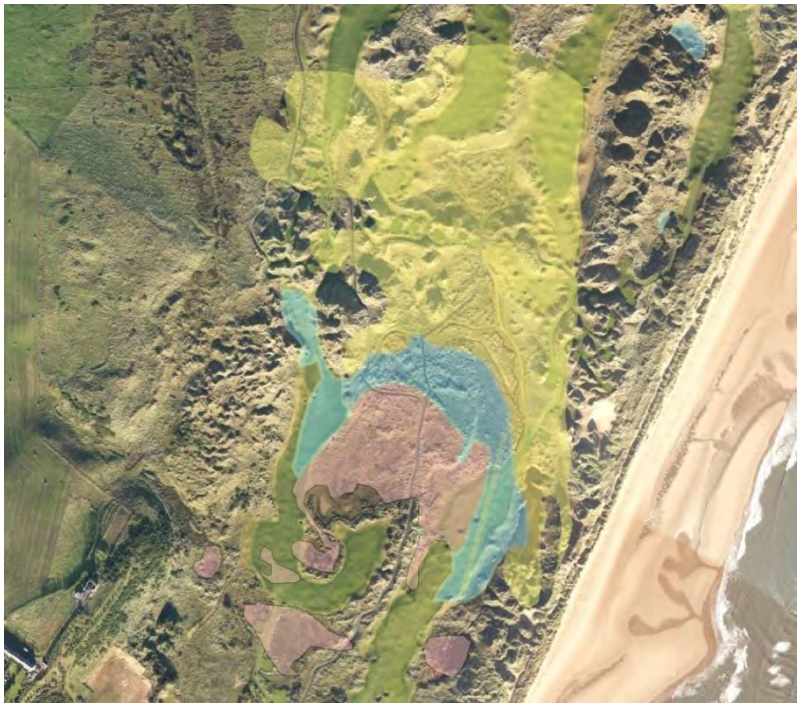

Fig. 14. Post-construction aerial from 2013 (CASL composite) overlain with former distribution of bare sand (pale yellow), young slack SD13 (pale blue) and mature slack SD16 (pink), illustrating impact on southern dune area. © SNH , licensed under the Open Government Licence, vegetation polygons © TIGLS

Fig. 15. Post-construction aerial from 2013 (CASL composite) showing detail of the current situation of southern dune area without any overlay. © SNH , licensed under the Open Government Licence

Fig. 16. Approaching 15th hole, looking from tee towards green. Note this image has not had colour manipulated in any way. Much of the area covered by this fairway had been an important young dune slack. (0218).

One of the most important features of the SSSI was the presence of a sequence of dune slacks of different ages and levels, in a highly dynamic dune context (Figs 10-14). These slacks are found mainly at Menie and Sandend, within the development site. This slack vegetation is referred to in the 1984 SSSI citation, though its full importance was not realised until the site was revisited in the context of the development. Not only has much of the dynamic context been removed as far as slack formation/movement is concerned, but following construction of the golf course the existing slacks have been substantially filled with sand, raising their levels, and in many cases establishing golf holes and infrastructure on the raised substrate. Though up to 41% of the deflation surfaces within the development site survive (Fig. 17 and geomorphology review) (retaining some rare species such as *Ophioglossum azoricum* and *Carex maritima*), it is unlikely that the majority of these will survive in the medium term in the absence of the geomorphological processes that formed them (i.e. the dune slack progression), Note that the 41% figure is a maximum, as it includes some water features. Dune slack habitat is regarded as very significantly damaged, especially in the areas now occupied by the 15th and 18th holes.

Fig. 17. Ophioglossum azoricum *in dune slack remnant (0184) 24 June 2013*

Fig. 18. Though some areas of flooded slack survive, they are within a highly artificial, stabilised context, and are unlikely to retain any interest in the medium term. (0144)

Mobile dune (including semi-fixed dune)

As befits a highly dynamic situation, there was a great deal of both mobile (SD6) and semi-fixed dune (SD7) on the development site prior to construction (Fig. 19).

Fig. 19. 2013 CASI composite overlain with SD6 mobile dune (pale green) and SD7 semi-fixed dune (purple). SSSI boundary in red. © SNH , licensed under the Open Government Licence, vegetation polygons © TIGLS

With the exception of some areas of mobile dune that had been associated with the sand sheets, the main concentration of mobile and semi-fixed dune was in the coastal strip. The coastal dune ridge itself has been left largely intact. One area of inland mobility has been stabilised and altered beyond recognition by the construction of the fairways for the 13th and 17th holes. Almost all of the fairway of the 14th hole has been constructed from former SD6 mobile and SD7 semi-fixed dune, so that this area of former instability has been substantially stabilised.

Fig. 20. 2013 aerial showing extreme fragmentation of dune habitat by pathways, in the area between the 13th and 14th holes. © SNH , licensed under the Open Government Licence

Fig. 21. 14th fairway, illustrating degree of habitat disruption resulting from separation of dune sections (0173)

Fig. 22. Eroded dune section, showing layer of stabilisation material (0226)

Heath

Much of the heath identified to the north of the Menie sand sheet during the 1999 survey had been covered by sand movement by the time of the 2006 survey , and most of the remainder had been lost as a result of unconsented overgrazing to the extent that heath was no longer considered a significant component of the sand dune feature of the SSSI (the 1999 survey shows no heath on Drum and Foveran Links). Though heath was identified as a major feature of the wider Menie Links in 2006, all of it was south of the SSSI apart from a very small area in the extreme SW of the SSSI (Fig. 23) and another small area found in the north of Menie Links in 2007. Though heath is mentioned in the SSSI citation, it has virtually disappeared from the entire SSSI by a combination of natural processes and overgrazing. These same natural processes might well lead to the re-emergence of heath on drier areas, but currently available information is that heath has been lost from the SSSI apart from two

very small areas. Despite the disappearance being largely due to natural processes due to natural processes, it is currently no longer an important habitat component of the SSSI's Sand dune feature and this must be considered within the review process.

Fig. 23. 2011 aerial of area south of SSSI showing former distribution of heath in relation to course construction. All the mapped heath is outside the SSSI. © Getmapping plc, vegetation polygons © TIGLS

Grey dune

This is a Priority habitat on Annex I of the Habitats Directive. The northern parts of the 14th and 17th holes have removed SD12 while parts of the 18th and 10th fairways have done the same, on a larger scale, in the south (Fig. 24). Overall much of the extent of grey dune has been retained. Though the fairways and access routes have disrupted continuity and coastal

processes (Figs 20-21), these are not quite as critical as in other dune habitats on this site.

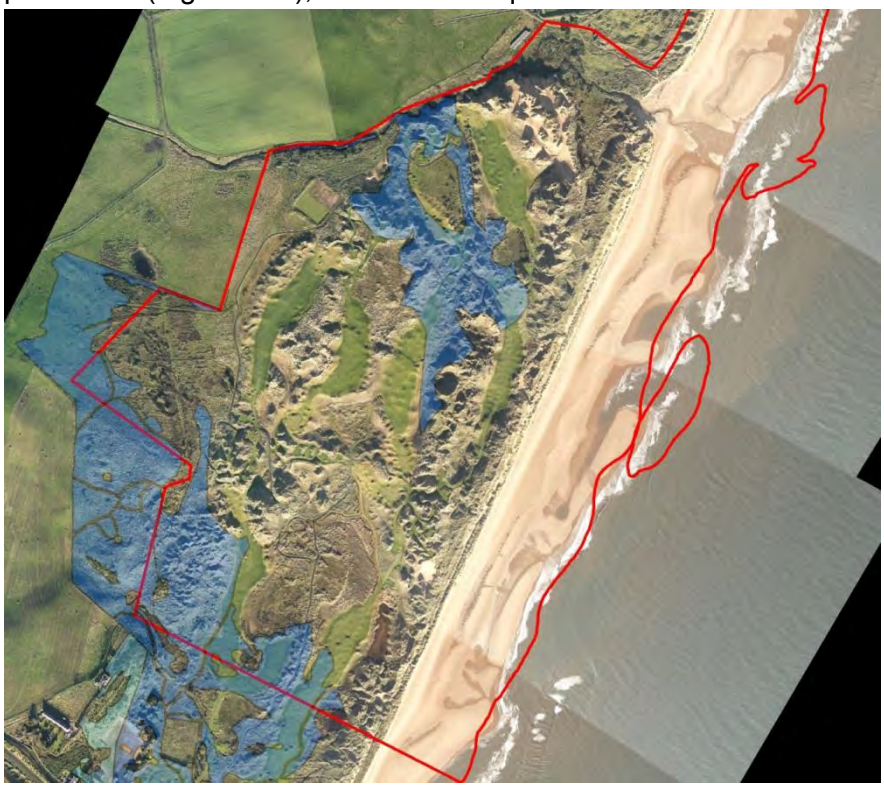

Fig. 24. CASL composite aerial imagery (2013) with grey dune shown in blue. SSSI boundary in red. © SNH , licensed under the Open Government Licence, vegetation polygons © TIGLS

Further considerations of the impact of the Golf course

Remaining area of existing SSSI from northern limit of golf course to River Ythan

Mobile dune and associated bare sand are well represented in Foveran Links; they lack the scale of interaction with slacks that had been so characteristic of the Menie section but remain an important habitat component and are of SSSI qualifying status in their own right. This is despite the near absence in the north of a semi-fixed component (based on Sand Dune Vegetation Survey of Scotland, Dargie 2000). Though, as stated earlier in the report, the bare sand is regarded as a critical element of dune functionality of mobile dune on this SSSI.

Fig. 25. Foveran Links SSSI showing northern dune slack surrounded by mobile and semi-fixed dune (0422)

Dune slack is represented within Foveran Links in the northern (unaffected) part of the SSSI (Fig. 25), but it has a more restricted distribution and is not as functionally important as it was on Menie Links in terms of new/mature slack development due to sand movement. However, the slacks at Foveran Links are still of sufficient extent and quality to qualify as SSSI status in their own right, having the best representation on this wider coast, with aspects surpassing even nearby Sands of Forvie (Mike Smedley, pers. comm.).

Fig. 26. Fairways consist almost entirely of very close-cropped grasses offering no cover for wildlife crossing from one side to the other (0290)

General ecological impacts

It is generally accepted that interruptions to natural habitat discourage linkages across these interruptions, in the sense that even though biota are physically able to cross or go around these interruptions, they tend not to do so, a factor known as the 'edge effect' or 'edge avoidance'. In this sense, the fairways present formidable 'biogeographical barriers' to movement between areas of natural or semi-natural habitat, with close-cropped grassland allowing no cover from predators (Fig. 26), and the fairway management discouraging the

establishment of wild plants, as well as disrupting continuity of ecological and geomorphological processes (see http://intranet/obr?id=A2279648) The geomorphological analysis suggests that the area of natural habitat within the Menie section of the SSSI fell from 39.6 ha to 18.5 ha as a result of golf course construction, a drop from 92% to 42%. An amount of habitat that is highly fragmented (and includes biogeographical barriers) is much less valuable in conservation terms than uninterrupted natural habitat of equivalent area.

The influences of anticipated irrigation were not immediately obvious, though extensive changes in water table and its depth will certainly have occurred due to the scale of sand redistribution. The intense green colour of the managed sections of the course contrasted very strongly with the less managed areas of rough, possibly reflecting the impact of irrigation or fertilisation, but the selection of highly coloured grass cultivars cannot be ruled out here. Significant use of fertiliser would be expected in a golf course of this type, but no vegetation impacts unambiguously attributable to this could be identified in natural or semi-natural sections, possibly reflecting their targeted use or the recent establishment of the course.

Impact of Golf Course on SSSI - Conclusion

1. Golf course construction has destroyed beyond recovery, damaged or severely modified substantial areas of semi-natural habitat in the SSSI. As a result the SSSI can be concluded to be 'partially destroyed'.
2. Successional processes exemplified by the movement of bare sand in two sections of the Menie Links have been curtailed or prevented. This will have a negative impact in the future on many remaining semi-natural habitats, in particular the dune slacks which require episodes of renewal.
3. Some semi-natural habitats remain intact at least for the short term.

Recommendations for the future status of the SSSI

SNH guidance on denotification (**SSSI Denotification**) states that

You may only propose the de-notification of all or part of an SSSI when you can show that retention of that land within an SSSI cannot be otherwise justified. It could be that it supports none of the natural features for which that site is notified, or the features are still found on the land but at a level that is no longer considered to be of special interest. .

The guidance notes the circumstances under which SSSI (natural) features can be considered to be lost. At Menie Links the categories which could apply would be:'*(d) the natural feature has declined, [or has been] lost or damaged beyond reasonable expectations of recovery.*

(e) our knowledge of the feature's distribution within the site has improved and it is now obvious that certain part(s) are unnecessary for its conservation. This might be for various reasons beyond the influence of site management or because all or part of the site has been damaged or destroyed, for example by development.

As concluded above, the golf course has resulted in significant areas of the SSSI being destroyed, damaged or modified. It would therefore be appropriate to consider the removal of some or all of these areas from the SSSI, but the question is which, and what should the remaining boundary be.

As part of this process it is also necessary to consider whether the remaining part of the SSSI would still qualify under the SSSI selection guidelines.

The above analysis employs the existing SSSI Selection Guidelines; these are under review but no changes to the Guidance on Coastal Habitats has yet been formally approved. Nevertheless the current draft http://intranet/obr?id=A2273531 is an advanced one that is likely to be close to any approved version, and relevant aspects of the new Guidance are given below.

Section 1.12 includes the text "Knowledge of coastal habitats has increased since 1989, especially how changes occur in response to environmental and human influences. Site selection and boundary definition should take account of short and longer-term dynamics and how these are influenced by coastal processes, storm events or a change in coastal management policy" which would address our concerns regarding the considerable reduction in dynamism and process dependency of habitats.

Section 5.1.2 makes recommendation for selections including (paragraph ii of section): "particularly well-defined or extensive zonations, including pioneer and mature communities and intermediate transitions or ecotones, including those that are typically species-poor or dominated by non-vascular plants or demonstrating vegetation types strongly influenced by maritime exposure". AS ectones have been severely disrupted by golf course construction the site would be less likely to qualify here.

Section 5.1.2 also (paragraph v of section) recommends selection of "important physiographic features with active processes functionally critical for coastal habitats.". This would apply particularely to the former areas of blown sand and the lost SD13-related processes.

Section 5.6 would also be relevant: "Coastal habitats within systems that support important physiographical features such as sedimentary processes, accretion/erosion sequences should also be selected. The selection of SSSIs for coastal geology and geomorphology is guided by the Geological Conservation Review (see May and Hansom 2003 and JNCC 1977). Other sites not listed by the GCR can also demonstrate good conservation of geomorphological structure and function. In particular, locations where new habitats are forming as a result of natural change or creation measures, active processes are essential to enable the habitats to develop. It is the interaction between these processes and the biological factors in habitat development which is important to include in the site series."

Dune slack processes are also relevant to 5.8: "Hydrology influences the extent and quality of coastal habitats, from small seepages on soft cliffs to underlying water tables in dune systems, as well as providing variation in saltmarshes where freshwater flows emerge onto the intertidal. Water quality, chemistry and availability need to be maintained to conserve these elements of the system, and good examples should be selected. The importance of considering the whole hydrological system means that the boundary should aim to include the wider catchment. Sites important for sand dune slacks, which rely on a discrete hydrological system recharged from rainfall (Davy et al 2010), may need the whole dune surface to be included in the boundary to ensure protection and restoration of

the water table." In respect of this section, it should be pointed out that I have receommended deleting the aim of notifying entire catchments.

Recommendations regarding SSSI status and boundary

In reviewing status, three main aspects are considered:

1) SSSI citation
2) Rationale for SSSI selection including selection criteria
3) Coastlands guidelines including selection criteria

The relevant part of the SSSI citation is given below:

> *Foveran Links contains extensive areas of mobile foreshore and sand dunes as well as fixed dunes, dune pasture, marshes and heath. The relationship between various plant communities and sand stability is clearly shown and the continuing movement of sand masses allow direct observation of these interactions.*

The other SSSI notified for its sandunes in the Gordon Area of Search is the Sands of Forvie and Ythan Estuary SSSI to the north (Fig. 27). Although similar, immediately adjacent and functionally linked to the Sands of Forvie and Ythan Estuary SSSI, the Foveran Links SSSI does contain several species and communities which are absent from or less well represented at Sands of Forvie. The vegetation of the dune hollows and pasture, some of which are grazed, are especially interesting.

As previously noted, the heath component is no longer present but its loss is due to natural dynamism, a factor that could well lead to the re-establishment of heath in the future, but in meaningful terms, heath is absent from the SSSI as currently assessed.

With the knowledge gained from more detailed survey and assessment as part of the PLI, it is clear that the greatest importance should be attached to "the continuing movement of sand masses allow direct observation of these interactions" which was recognised as conferring not only particular interest, but identified the unique nature and scale of the interactions between sand movement and slack development, a uniqueness that is now lost: the main interest was at Menie and Sandend, where the movement has been stabilised and most of the dune slack lost. This removes a very significant aspect of the interest from the Menie/Sandend section of the SSSI. Though the degree of importance was not recognised until the development was assessed, this aspect is clearly identified in the citation, and is clearly lost from the area covered by the development.

The dune communities that were better represented in Foveran Links SSSI than at Sands of Forvie, are still present in Foveran Links, though more poorly than they were at Menie Links. They also still exist at Menie Links, but are very much more restricted in extent, and are not expected to survive in the medium term as they are heavily or entirely dependent on functionality that has been lost from Menie Links.

In terms of the SSSI citation, there has been significant loss of interest from the SSSI overall, but sufficient interest is retained in Foveran Links to retain the existence of an SSSI

here. However, the loss of citation-related interest from Menie Links is such that SSSI status can no longer be justified there.

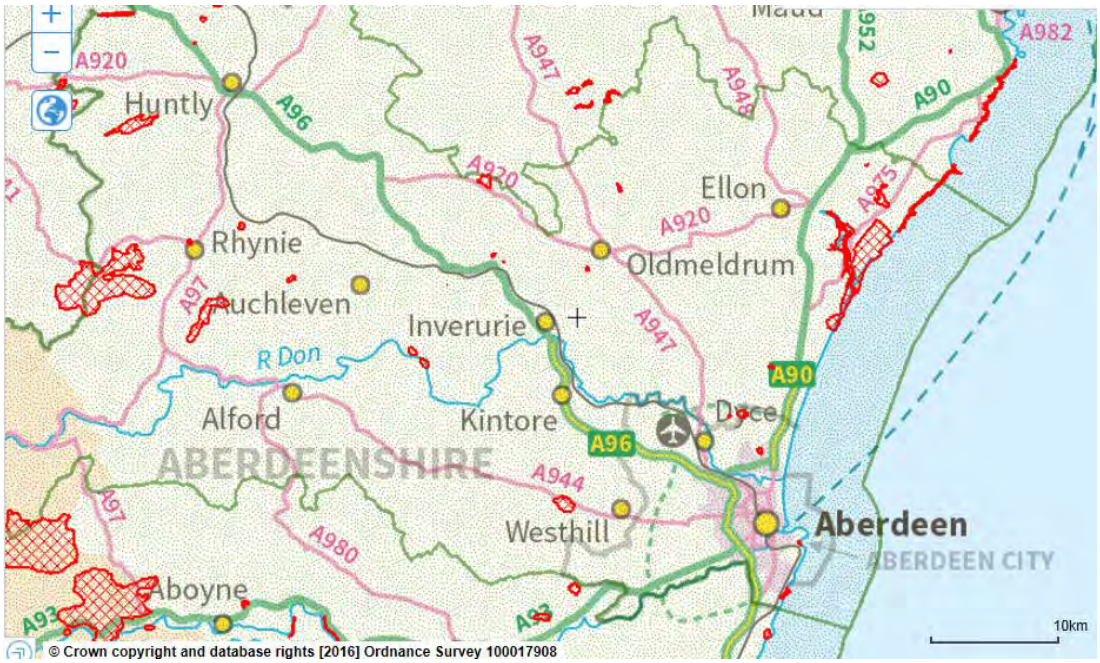

Fig. 27. Area of Search applicable to Foveran Links SSSI (green) showing all SSSIs in red.

The situation encountered during the 2013 visit was assessed in relation to the *Guidelines for the selection of biological SSSI* (http://jncc.defra.gov.uk/page-2303#SSSI), Part 1: Rationale and Part 2: Section 1a Coastlands. The Rationale has recently been updated (2013) but the Coastlands guidelines (Section 1a) are under review; the review of coastal guidelines remains active, and only guidelines that are already accepted are employed here.

The Rationale accepts (3.2) that "special scientific interest is a matter of informed expert judgement rather than simply the rigid application of objective rules." And that this 'expert judgement' will derive from the Statutory Nature Conservation Bodies (i.e. SNH in Scotland). Site selection is partly based on the concept of Area of Search, which in this case extends from around Cove Bay in the south to Whinnyfold in the north (Fig. 27).

The criteria for site evaluation identified by the Rationale in the revised guidelines abolished the distinction between primary and secondary criteria and listed the following criteria (cited text in brown):

- typicalness
- fragility
- size
- diversity
- naturalness
- rarity
- recorded history
- position in an ecological / geographical unit (ecological coherence)
- potential value

The application of these criteria is complex, and different criteria, combinations or emphases are needed for evaluation and selection between:

- the use of the exemplary site and critical standard principles
- habitats and taxonomic groups

and within

- individual habitats
- taxonomic groups.

The 2013 revision also added

- ecological coherence and
- potential value

It is not the intention to review each and every one of these criteria, and it is not necessary to reach any particular standard individually or wholly across the criteria (e.g. typicalness and rarity might appear mutually exclusive), and 'expert opinion' has been exercised.

In terms of **size**, the interest has clearly been reduced in the southern part of the SSSI as covered by the golf course. However Foveran Links alone would comply with this criterion, as it is large enough on its own to comprise a functional unit. **Naturalness** has clearly been particularly adversely affected – the golf course constitutes an intrusion into this concept, by fragmenting the habitat with highly unnatural, intensively managed, close-cropped swards. Foveran Links is less natural than Menie Links had been, and contains remains of wartime structures. Though these are of undoubted historic importance, they can only be regarded negatively within strict application of the SSSI criteria. The existing SSSI is thus rather less natural than before, and the southern section, represented by the golf course footprint, completely fails the criterion for naturalness. The selection criteria are clear in their acceptance that all land in Great Britain is to some extent unnatural, and the term is used here comparatively rather than absolutely. **Rarity** would have applied to the SD13 young dune slack, with the best representation in the UK within the area now covered by a golf course; this habitat is now much reduced and has poor prospects of survival.

The Introduction to the Coastlands section of the guidelines (1989, awaiting revision) states:

The most important sites are therefore those with some or all of the following attributes:

> 1.4.1 the widest range and the best examples of the main NVC communities and of other coastal vegetation types not described in the NVC;
>
> 1.4.2 a complete succession or zonation, including pioneer and mature communities;
>
> 1.4.3 transitions to other, terrestrial vegetation types;
>
> 1.4.4 a large area or lateral extent (in continuous or discrete units depending on the degree of natural or man-made interruptions);
>
> 1.4.5 important physiographic features.

These attributes are reviewed in turn.

1.4.1 the widest range and the best examples of the main NVC communities and of other coastal vegetation types not described in the NVC;

This range has been reduced by the loss of most heath, and the unnatural loss of most dune slack, especially SD13. The SNH case at the PLI stated (Angus 2008):

Assuming no significant change at other sites, the site of the proposed development now holds 98.67% of Scotland's resource of SD13 young dune slack, and 13.18% of the Great Britain resource

Because virtually all of the [known] SD13 in the SSSI was within the development site, and most of this is either gone or seriously threatened by the halting of sand movement, this means that Scotland has lost almost all of its SD13 and the GB resource is severely depleted.

1.4.2 a complete succession or zonation, including pioneer and mature communities;

Succession was largely a feature of the Menie Links and Sandend Links dynamism, and that succession, with its associated pioneer (SD13) and mature (SD16) dune slacks, has been lost in functional terms from the development site due to extreme sand redistribution and stabilisation. It now (2013) has rather poorer representation at Foveran Links, but it is still an important habitat component of the SSSI.

1.4.3 transitions to other, terrestrial vegetation types;

Transitions are still present, but these are transitions that occur on most sand dune SSSI. The rare transitions associated with sand sheet progression have been lost, but the typical transitions have been retained over the SSSI as a whole. However, the fragmentation caused by golf course construction and management have destroyed a substantial proportion of the transitions in Menie and Sandend.

1.4.4 a large area or lateral extent (in continuous or discrete units depending on the degree of natural or man-made interruptions);

As above, the fragmentation due to the golf course construction and management have destroyed a substantial proportion of the continuity of habitat in Menie and Sandend. Sand dune habitat in the development site is regarded as 'highly interrupted'.

1.4.5 important physiographic features

It should be noted that these are included within the selection criteria for **biological** SSSI. As noted above, the Menie section of the Foveran Links SSSI was of particular importance for demonstrating the links between geomorphological processes and ecological

interest. The importance of the physiography has been effectively removed from the golf course footprint.

Guidelines for Sand dunes (1989, section 5),

5.5 Selection requirements

As with salt marshes, sand-dunes need to be treated as whole ecosystems, with suites of plant communities in successional sequence characteristic of the particular region.

5.6 Because of the truncation of many dune systems, caused by afforestation and other developments, sites with a complete succession from accreting foredune to stable dunes with grassland, heath or native scrub are of prime importance.

The guidelines recognise the following sand dune selection units which could be represented on a site.

5.6.1 Mobile and yellow dune

5.6.2 Calcareous dune

5.6.3 Dune slack

5.6.4 Acid dry dune grassland and dune heath

5.6.5 Dune scrub

Within each AOS, the following are *eligible* for selection.

5.6.6 Any dunes systems exceeding 200 ha in area

5.6.7 If not covered by 5.6.6 the largest dune systems with acidic, intermediate and calcareous substrates or representing different structural types.

5.6.8 The best example of any dune system containing [certain specified] plant communities represented by selection under 5.6.6 and 5.6.7 or occurring as better examples or in different combinations and relationships.

5.6.12 It is important that within this selection the best examples of the range of physiographic features, representing the different processes of dune formation, are included.

These selection criteria are reviewed in turnIn respect of Sand Dune (Section 5), Foveran Links SSSI would still qualify for selection in part because of:

“As with salt marshes, sand-dunes need to be treated as whole ecosystems, with suites of plant communities in successional sequence characteristic of the particular region” (5.5) and “It is important that within this selection the best examples of the range of physiographic features, representing the different processes of dune formation, are included” (5.6.12).

The overall conclusion is that the area of the Foveran Links SSSI occupied by the recently constructed golf course falls well below that required of an SSSI. This applies to the entire footprint of the golf course, not just that part consisting of tees, fairways, greens and associated infrastructure. The “relationship between various plant communities and sand stability” referred to in the SSSI citation has deteriorated to the extent that it is no longer

valid for this southern part of the SSSI. The loss of habitat functionality resulting from sand stabilisation is very severe, to the extent that that part of the interest dependent on progression of the sand sheet (mainly dune slack) is effectively destroyed. Other dune habitat – mainly mobile and semi-fixed dune but also grey dune, has been substantially fragmented and disrupted and, while remnants occur within the development site, they do not reach the level of representation or interest required for SSSI status.

The interest of the SSSI as a whole is significantly diminished by the stabilisation at Menie. The mobility and associated slacks still present at Foveran are still of SSSI qualifying status in their own right, but are not of the quality previously present at Menie and Sandend. However, the SSSI north of Menie/Sandend retains sufficient extent and quality of dune habitat to continue to meet SSSI status in its own right. Important aspects of the SSSI interest, as defined by the SSSI citation and the SSSI selection criteria have been lost or severely damaged by the construction of the golf course, as foreseen in the SNH responses to the development proposal and, indeed, by the developer's own Environmental Assessment.

It is thus the unqualified recommendation of this review that, in the absence of other potentially qualifying features which are not considered here, the southern section of the SSSI corresponding to the footprint of the golf course, be denotified, as it is no longer of sufficient interest, having been "lost or damaged beyond reasonable expectations of recovery" in respect of the Sand dune SSSI feature. It might be technically possible to restore the interest by large-scale destabilisation, but this cannot co-exist with the golf course, so for as long as the golf course occupies this land, it will lack SSSI levels of biological interest.

Boundary position

The question of where the new southern boundary of the SSSI should be then arises.

A section on sand dune boundaries is included in the Guidelines at 11.2.7

11.2.7 Normally those systems which have been identified as being of importance will be included in totality; i.e. the site selected will include the whole system together with the sandy shore above Mean Low Water Mark. However, there are many examples of dunes which have been modified by man's activity and where the decision is not always clear. The most frequent of these are considered below.

11.2.8 Golf courses (links): These may not always be highly modified and may contain, particularly in the non-intensively managed 'roughs', substantial areas of important vegetation. Intensively managed greens, tees and fairways are usually of limited interest and should be excluded where they form a substantial proportion of the site.

Fig. 28. Dune immediately north of course (0241)

Fig. 29. CASL 2013 aerial of area covered by possible new SSSI boundary © SNH , licensed under the Open Government Licence

Though there is a clear distinction on the ground and in aerial imagery between the golf course and what appears to be dune habitat (Fig. 29), there are potential problems in using this as an SSSI boundary. It is entirely possible (even likely) that NE winds could cause substantial movement of sand from dune to golf course, giving rise to requests from the

course managers to extend their stabilisation, which would be difficult to resist given the extent of habitat loss already experienced.

The Sandend Burn appears to provide a viable and reasonably stable (in the medium term) feature that could be used as a southern boundary, but this would leave a narrow section at the extreme south of the SSSI that would not withstand close scrutiny in respect of its SSSI status. It is narrow and constrained inland by agriculture, and lacks any particular features of interest (presence of a component habitat of a SSSI feature does not automatically confer interest). It seems likely that this section was within the SSSI as a link between the northern and southern section of the SSSI, a function that is no longer required.

It is thus recommended that the natural feature of the Drums Burn be used as the new southern boundary of the SSSI.

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FOVERAN LINKS SSSI – REVIEW OF SSSI NOTIFICATION FOLLOWING CREATION OF MENIE LINKS GOLF COURSE

Summary

1. Foveran Links SSSI is 203 ha in area and comprises approximately 154 ha of dune habitat and 49 ha of intertidal sand.

2. The construction of Menie Links Golf Course has partially destroyed the Coastal Geomorphology of Scotland and Sand Dune habitat notified natural features within the SSSI as well as interrupting natural dune processes. Together, this combined loss and damage represents 11% of the total SSSI and 15% of the sand dune habitat.

3. 34% (23 ha) of the semi-natural habitats in the Menie Estate section of the SSSI has been destroyed or severely modified; the remaining 66% (44 ha) has become fragmented and will likely suffer further adverse effects as a result of the severe restriction of natural dynamic geomorphological processes necessary to sustain the natural interest.

4. Whilst some of the remaining fragmented habitats are of nature conservation value, they are not of SSSI quality. The management intervention proposed is unlikely to be sufficient to replace the natural cycle of dune succession.

5. Taking all of this in combination, we recommend the removal of the entire Menie Estate section and the adjoining Drums Links from the SSSI as we advise that retention of that land cannot be otherwise justified.

6. The case for a remnant Foveran Links SSSI on biological grounds is not strong, having been significantly weakened by the golf course construction.

7. It is therefore recommended that after the boundary has been amended the remaining SSSI should be merged with the immediately adjacent Sands of Forvie and Ythan Estuary SSSI. The two sites complement each other and a single site would place the GCR site, which is a single functional unit, within a single SSSI.

Action

8. **Under delegated authority by the SNH Board, Director of People and Nature is invited to approve the proposed de-notification of part of Foveran Links SSSI under Option 3 and the next stage which involves formal consultation with interested parties.**

9. **Director of People and Nature is also invited to support the proposed merger of the remainder of Foveran Links SSSI with the immediately adjacent Sands of Forvie and Ythan Estuary SSSI, subject to the outcome of the formal consultation on the proposed boundary changes to Foveran Links SSSI.**

Preparation of Paper

10. Paper prepared by Neale Taylor in collaboration with Stewart Angus, Sue Lawrence, Alistair Rennie, Mike Smedley, Des Thompson, John Kerr, Denise Reed and Arthur Keller.

Background

11. SNH periodically reviews the boundaries of designated sites which have been subject to adverse impacts from development or other management pressures. Foveran Links SSSI has been identified as a priority for review along with a number of other sites across Scotland (see A2529746).

12. Foveran Links SSSI lies 10 miles north of Aberdeen. It was notified under the Wildlife and Countryside Act in 1984. The citation for the SSSI (Annex 1) states that the features of interest include: the dune habitats, especially the dune hollows and pasture; and the geomorphological interest of its sand dune system due especially to its dynamic nature. A map of the SSSI is in Annex 2. The northern part of the SSSI is part of Forvie Geological Conservation Review site (Annex 3).

13. The SSSI consists of three areas or links: Foveran Links in the north (after which the SSSI is named); Drums Links towards the centre; and part of Menie Links in the south. Menie Links is owned almost in its entirety by Trump International Golf Links Scotland (TIGLS) which comprises approximately 47% of the sand dune habitat and 33% of the whole SSSI. The SSSI is immediately south of the Sands of Forvie and Ythan Estuary SSSI which is also, *inter alia*, notified for its sand dune habitats and contains the rest of the Forvie GCR site.

	Area in SSSI ha	**% of Foveran Links SSSI**
Foveran Links SSSI	203.2[1]	100
Sand dunes	153.9	75.7
Intertidal zone[2]	49.3	24.3
Menie Estate	67.2	32.9
Area of planning consent for Golf Course	43.5[3]	21.1

14. For the purposes of Site Condition Monitoring Foveran Links SSSI is considered to be notified for its Sand dunes and Coastal Geomorphology of Scotland.

15. After a Public Local Inquiry, planning permission was granted in 2008 for a golf course on the Menie part of the SSSI owned by TIGLS. The major part of the course was completed by the summer of 2012 when the course was opened.

16. SNH stated at the PLI that the Golf Course would have serious consequences for the SSSI and would result in significant areas losing their scientific interest through direct loss of habitat and land forms, through golf course management and through the virtual cessation of natural movements and cycling of sand in the dune complex.

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[1] Most recent measured area according to SiteLink
[2] Area below Mean High Water Springs – owned by Crown Estate Scotland
[3] From Rennie A1884376

17. SNH undertook a review of the documentation of SSSIs in Scotland (known as the Nature Conservation Act Review) which was to have been completed by March 2011. The review of Foveran Links SSSI was postponed to await the completion of the golf course in 2012. The NCA Review now requires to be completed.

18. The NCA Review would include a review of: the citation, map, list of Operations Requiring Consent, SNH's SSSI consents for each owner or occupier, and the Site Management Statement. The review should be carried out once options for the boundary changes have been resolved.

19. Cycle 3 Site Condition Monitoring of the two features in the SSSI has been completed and the results put onto SNH's website and sent to all owners and occupiers. It was concluded that both the Coastal Geomorphology of Scotland and the Sand Dune habitat were 'partially destroyed' as a result of the golf course construction. This is a standard descriptor used under the Common Standards Monitoring protocols when a feature has been adversely affected and there is no prospect of recovery.

Impacts of Menie Golf Course on Foveran Links SSSI

20. Two reviews of the impact of the golf course as part of the Cycle 3 SCM assessment and the NCA Review have been carried out on the geomorphology and sand dune habitats of the SSSI by SNH specialist advisers Alistair Rennie (AR) and Stewart Angus (SA) (See A1884376 and A1886119 respectively).

21. As predicted by SNH at the PLI, the course (Annex 4) has had a major negative impact on the notified features of the SSSI (see table below). 53% of the semi-natural habitats in the SSSI within the development footprint of the golf course has been destroyed or severely modified through earthworks, conversion to intensively managed greens, tees, roughs and fairways, access tracks and other infra-structure, or conversion into stabilised dunes through marram planting. This is equal to a 15% loss of the SSSI's sand dune habitat (ie. excluding the inter-tidal zone).

Table 1. Sand dune habitat in Foveran Links SSSI directly impacted and unaffected by golf course construction (see Annex 5).

Impacts of Golf Course construction	**Area ha**	**% of area granted planning consent in SSSI**	**% of part of Menie Estate in SSSI**	**% of Sand dune habitat in Foveran Links SSSI**	**% of Foveran Links SSSI**
Permanent loss, ie to infrastructure	14.9[3]	34.3	22.2	9.7	7.4
Severely modified eg landscaping	8.1[3]	18.6	12.1	5.3	4.0
Total directly impacted	**23.0**	**52.9**	**34.3**	**15.0**	**11.4**
Habitat fragments unaffected directly in area of SSSI granted planning consent	20.5	47.1	30.5	12.5	9.8
Habitat in Menie Estate outwith area of planning consent[4]	23.7	n/a	35.3	16.2	12.0
Total not directly impacted	**44.2**		**65.8**	**28.7**	**21.8**

22. The construction of Menie Links Golf Course has removed the vast majority of the geomorphological interest within the vicinity of the golf course. Of particular note are the losses of 99% and 90% of the Menie and Sandend sand sheets respectively (Annex 6) – both key geomorphological features in the SSSI illustrating the unusual dynamic nature of the Menie Links sand dune system – as well as the loss of 64% of the dune slacks/open water habitats in the estate, rare features in the UK which require episodes of renewal through sand movement.

23. The Forvie GCR site is outwith the development site and has been unaffected by it. However, the geomorphological systems and sand dune habitat interests at Menie have been partially destroyed (See Loss and Damage Form A816971 and SCM assessment Management Notes A254346 and A543969 at June 2013).

24. The negative impacts on the Sand dune habitat feature include:

    a. permanent direct loss of habitat, i.e. conversion of semi-natural habitats to golf course infra-structure (including tracks, tees, fairways, greens, water features)
    b. potential indirect impacts from the use of irrigation, fertilisers and herbicides which in time may affect plant communities
    c. stabilisation of mobile sand which has destroyed the dynamic nature of the site and the cycle of habitat creation which is necessary for periodic renewal of sensitive habitats such as dune slacks and mobile dune.
    d. control of grazing (rabbits, deer) which will in time result in scrub and coarse vegetation development in sensitive habitats such as dune slacks and wetlands.

[4] Eg. the coastal dune ridge and previously grazed land in the west of the estate

25. As well as the loss or modification of habitats there has been significant fragmentation of habitats across Menie Estate (Annex 5). This means that even habitats not directly affected by the golf course construction have been left isolated on the west side of the SSSI (areas of rough and dune grassland). Within the golf course footprint there are significant blocks of unmodified semi-natural habitat remaining; in some cases these are more of less intact blocks such as the dune heath area, but most are themselves fragments of larger blocks (such as the dune slacks). On the east side is the main coastal dune ridge which has been left for coastal defence purposes but is itself isolated from habitats in the hinterland.

26. These fragments will no longer be affected by and in some cases periodically rejuvenated by sand movements. They are vulnerable to adverse effects such as changes in ground water quality and flow rates, lack of grazing management and accumulation of organic materials, all of which are very likely over time to significantly alter the composition and structure of these areas and in most cases lead to reduced nature conservation value.

27. There are other SSSIs in Scotland which contain golf courses. The Menie Links section of the SSSI, and the impact of the new golf course upon it, presents a different and more extreme example of the impacts that can occur. Most importantly the golf course has prevented all large-scale geomorphological processes which underpin the biological interest of the Site as well as destroyed or severely modified over 50% of the semi-natural habitats in the footprint of the development. Other dune SSSIs in Scotland were mostly notified after the golf courses were constructed as they represented amongst the best examples of sand dunes within their area of search or safeguarding the notified features was an objective of the course construction. In this case the impact of the golf course has been severe and there are still areas of sand dunes in the Gordon Area of Search which qualify and are notified as SSSI.

Implication for the future of the SSSI

28. Most of the Menie section of the SSSI is covered by the planning consent for the golf course (see maps in Annexes 4 and 5). This effectively means that in this area the land owner does not require SNH consent to carry out management subject to the planning permission for golf course construction and maintenance.

29. There were a number of proposals for habitat management and monitoring laid out in various plans associated with the planning approval which included:

    a. Scrub control of the dune slack which will largely involves the control of regenerating goat willow,
    b. Periodic intervention involving re-scraping (excavating) etc. to rejuvenate stabilised slacks and to maintain young dune slacks at a similar percentage as was represented pre-construction.
    c. Monitoring of the condition of the dune slacks as an on-going requirement.

30. TIGLS are currently carrying out control of invasive species such as rosebay willow herb which is widespread in Foveran Links SSSI and the Sands of Forvie and Ythan Estuary SSSI.

31. We are actively working with TIGLS to encourage this beneficial habitat management and monitoring. It remains to be seen if these plans are enforceable. Even with these actions being carried out and effective, they do not mitigate the damage to the SSSI nor provide significant compensation. Neither would the active management sufficiently re-create the succession previously created by the dynamic coastal processes.

Options Appraisal

32. Given the large-scale changes and impacts as a result of the golf course it is necessary to consider the following:

    a. Should the existing boundary be kept the same or should it be modified?
    b. Would a reduced Foveran Links SSSI still qualify as an SSSI under the current SSSI guidelines; if so for which features, and are there other options?

33. Annexes 9 and 10 lay out relevant sections of the SSSI Selection Guidelines and SNH's Denotification policy. In the context of these the following options for a reviewed boundary for the SSSI have been identified:

Option 1 – Do not amend the boundary containing the Menie Links golf course;

Option 2 - Exclude areas of intensively managed land, altered topography and manipulated dunes and sand sheets, and land on which there are artificial structures;

Option 3 - Exclude the whole of the Menie Estate section of the SSSI plus adjacent isolated remnants of low value habitats (including Drums Links).

Option 1 - Do not amend the boundary

34. A significant proportion of the Menie section of the course is now intensively managed grassland which has been created by importing or moving large quantities of sand/soil on which refined varieties of grass are grown, which may be irrigated and to which fertiliser and probably pesticides are regularly applied. These areas possess little biodiversity interest. There are roads and tracks and other infra-structure through the site for which there is no prospect of the restoration in the long term. In addition there are areas of stabilised sand sheets (planted with marram grass) and other areas which have been landscaped and which are no longer natural habitats. This option would mean that areas would persist in the SSSI with no scientific interest. The criteria for removing some or all of the affected areas of the SSSI are therefore met and should be considered.

Option 2 - Exclude areas of intensively managed land, altered topography and manipulated dunes and sand sheets, and land on which there are artificial structures

35. Within the golf course construction boundary the most obvious option would be to exclude the most intensively managed areas (tees, greens and fairways) and artificial structures on the basis that these areas possess no scientific interest and there is no prospect of restoration as they are key to the golf course. It is estimated that within the Menie Estate section of the SSSI some 15 ha of the SSSI is subject to intensive management of these types.

36. In addition some 8.1 ha of vegetated dunes have been created through landscaping to create playing surfaces and/or planting with marram for stabilisation. These areas are therefore no longer natural and have little biodiversity interest.

37. Removing these areas from the SSSI would leave around 20 ha of fragments of pre-golf course semi-natural habitat in the footprint of the planning consent along with another 24 ha of isolated areas in the remainder of the estate (including the coastal dune ridge), and some fragments along the Sandend Burn (see Annex 5). The key question is what scientific interest and long term viability is there in these remaining fragments. If they are considered to retain scientific interest then they could be kept in the SSSI, if not then they should be excluded as well.

Option 3 - Exclude the whole of the Menie Estate section of the SSSI plus non-viable parts of land adjoining the Sandend Burn and Drums Links

38. Alistair Rennie concluded that, 'within the vicinity of the golf course the geomorphological processes and features which supported the designated ecological interests are no longer operational or present … this analysis suggests that the ecological designation is untenable within the footprint of the Golf course'.

39. Most of the habitats in a dune system are in a state of succession. At its simplest the fore dunes mature into fixed dunes, which mature into dune grasslands or heath, and ultimately scrub and woodland. If dune slacks are created then they gradually infill with loose sand and the accumulation of fen peat, ultimately beginning to dry out. The shifting sand sheets at Menie and the consequent recycling of sand led to constant destruction and renewal of these habitats – the prevention of sand movement necessary for the golf course construction has completely stopped these processes.

40. This means that the remaining fragments of dune habitat (Annex 5) will now continue to mature and change into other habitats. The habitats which were of particular value will decline in value or disappear: the rare species of dune slacks, such as curved sedge *Carex maritima*, small adder's-tongue fern *Ophioglossum azoricum* and allseed *Radiola linoides,* will decline as coarser species of heath, grassland, rush and scrub increase; dune grassland will either mature into heathland or perhaps become dominated by species such as false oat grass, a common species of coarse grassland or scrub. The coastal dune ridge may mature into dune grassland, or may in turn suffer erosion and blow outs which the Golf course may have to manage to protect the adjacent holes.

41. A site visit in November 2017 showed that the slacks immediately adjacent to Hole 15 have already begun to change only 5 years after the course construction, possibly encouraged by nutrient inputs from adjacent greens and fairways. Scrub development was also clearly occurring more widely.

42. The sand sheet at the north end of the golf course and to the south of the Sandend Burn has been largely stabilised with marram grass (see Annex 5 and 6). This area could continue to move northwards into the burn and, conceivably, be replaced by more sand in a microcosm of the system which formerly existed at Menie. However, the area is small and Alistair Rennie's report states that 90% of the original sand sheet here has been lost, and there is no guarantee that it would in time be replaced. It is immediately adjacent to the 15th hole, and loss of sand from this area might have knock on effects on the stabilised area necessitating action in the future.

43. The only other way of preserving many of these communities is through the sort of direct but artificial intervention proposed in the Trump International Golf Links Scotland prepared Habitat Mitigation and Compensation Plan that accompanied the full planning application for the golf course. It is questionable even so whether management to manage succession and sand movement would be able to sufficiently maintain these areas in their current form, whilst acknowledging some species and their habitat can be retained through intervention. Also, these habitats have become fragmented and have lost their natural context within a functional dune system.

44. It is concluded that the main negative effect of the golf course has been to prevent the dynamic processes which created the scientific interest of the Menie Links, and then ensured that dune habitats was regularly renewed, ensuring that niches for the rarer species and the full range of dune biodiversity in the SSSI were maintained.

45. It is very likely that many of the remaining original natural habitats will in time change and lose their scientific interest, in particular the rarer species with the most demanding ecological requirements.

46. **It is concluded that the whole of the Menie Estate section of the SSSI (and the adjacent intertidal zone) should be removed from the SSSI. This would be the preferred option on its own but it is complicated by the need to consider certain small areas that would be left isolated in the SSSI or are potentially non-viable or of little interest on their own.**

47. If the whole of the Menie Estate section is excluded then as the map in Annex 5 shows there will be some small areas in other ownership along the Sandend burn to the north which would remain as isolated fragments. These are largely areas of rough grassland with little scientific interest.

48. Further north there is a narrow area of dune known as Drums Links which backs onto fixed dune heavily grazed by livestock (outside the SSSI).

49. Drums Links is functionally separated from Menie Links by the Sandend Burn, and from Foveran Links proper to the north by the Drums Links Burn. Sand dune development inland has been abruptly truncated by agricultural improvement, and at their narrowest the dunes are only around 28m deep; the SSSI boundary is currently an undefined line running through the grazed area inland of a fence line. Although it has not been affected by the Menie golf course construction and is still recognisably sand dune habitat (in contrast to the areas along the Sandend Burn), it is likely that this area was only included in the original SSSI because it formed a link between the Foveran and Menie Links sections of the SSSI. If the Menie Links section is removed from the SSSI there is no longer an argument for this link. There is no particular scientific interest in this area and there is no compelling reason to retain it within the SSSI. Removal of Drums Links from the SSSI has been recommended in both the reviews by Alistair Rennie and Stewart Angus. **This is the recommended option.**

Conclusion

50. The preferred option is to remove the entire 67 ha of dune habitats of the Menie Estate section from the SSSI along with foreshore (26 ha) and isolated fragments and sub-optimal habitats along the Sandend Burn and the truncated sand dunes in Drum Links (7ha). It would remove the habitats directly damaged or destroyed by the golf course construction, the fragments of remaining habitat which are unlikely to be viable in the medium term, and other fragments of habitat with little or no value. The remaining SSSI would consist of functional dune systems which should be resilient and self-sustaining.

Would Foveran Links still qualify as an SSSI with the boundary modifications recommended above?

51. As explained in para. 23 the Forvie GCR site was unaffected by the golf course, and therefore this section of the SSSI still qualifies on geological grounds (See map in Annex 3). There is an area south of the GCR site as far as the Drums Links burn which is not in the GCR site.

52. The removal of approximately 51% of the SSSI and 48% of the sand dune habitat in the SSSI under Option 3 would have a significant impact on the biological reasons for notification of the SSSI. The draft table in Annex 11 summarises the features which would qualify for notification in the current SSSI and the remnant SSSI under Option 3.

53. In summary, the case for a remnant Foveran Links SSSI on biological grounds is not strong, having been significantly weakened by the golf course construction.

Merger with Sands of Forvie and Ythan Estuary SSSI

54. The historic decision to have two sand dune SSSIs which are immediately adjacent to each other in the same Area of Search has in recent years looked anomalous. Why this occurred is not clear, but may have resulted from the different ways that National Nature Reserve and non-NNR land were notified as SSSIs under the Wildlife & Countryside Act (1981). However following changes to the legislation under the WANE (Scotland) Act 2011 the opportunity now presents itself to merge the remains of the Foveran Links SSSI with Sands of Forvie SSSI.

55. The table in Annex 11 details the effect of merger on the criteria for selection of a combined site. In summary, as might be expected, the two sites complement each other and the result would be a larger site with more clearly defined notified features. A single site would place the GCR site (a single functional unit) within a single SSSI which is a much neater situation than at present.

56. The process of unifying two SSSIs is straight forward and does not require the same consultation procedure as over a new SSSI or an extension to an SSSI. However for legal reasons it could only take place after the Foveran Links SSSI boundary changes have been confirmed.

57. It is recommended that the residual Foveran Links SSSI is merged with Sands of Forvie and Ythan Estuary SSSI if Option 3 is approved and confirmed after public consultation.

Denotification and merger procedures and resource implications

58. Annex 12 describes the process needed to denotify part of the SSSI and carry out the proposed merger. In summary there are informal and formal consultations with owners and occupiers as well as a public consultation process. Objections by land owners on scientific grounds would be referred to the Director of People and Nature in the first instance.

Outcome of informal consultations with land owners

59. A summary of the informal consultations is given in Annex 8. TIGLS have indicated that they would prefer the boundary of the SSSI to remain the same. Neither of the other owners, [redacted] and Crown Estate Scotland indictaed that they had an objection to Option 3.

Communications

60. There is very likely to be press coverage and SNH should devise a communications line in advance to deal with responses from the media.

Recommendations

61. It is recommended that:

- The part of Foveran Links SSSI consisting of Menie Estate (ie. the land owned by TIGLS) and Drums Links should be denotified along with the adjacent inter-tidal area owned by Crown Estate Scotland, and formal consultation with interested parties be commenced.

- If this denotification is subsequently confirmed the remainder of Foveran Links SSSI should be merged with Sands of Forvie and Ythan Estuary SSSI.

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Annex 1. Foveran Links citation

FOVERAN LINKS
SITE OF SPECIAL SCIENTIFIC INTEREST

Gordon District

Midas Reference: 659

PLANNING AUTHORITY:	Gordon District Council
DATE NOTIFIED UNDER 1981 ACT:	14 February 1984
NATIONAL GRID REFERENCE:	NK 000225
OS 1:50,000 SHEET NO:	40
1:25,000 SHEET NO:	NJ 92
AREA:	203.2 ha.

DESCRIPTION:

Biological

Foveran Links contains extensive areas of mobile foreshore and sand dunes as well as fixed dunes, dune pasture, marshes and heath. The relationship between various plant communities and sand stability is clearly shown and the continuing movement of sand masses allow direct observation of these interactions.

Although closely linked and similar to the Sands of Forvie and Ythan Estuary NNR to the north, the site does contain several species and communities which are absent from or less well represented in the NNR. The vegetation of the dune hollows and pasture, some of which are grazed, are especially interesting.

The Links are well-known for the range of migrant birds which occur and for the large moulting and passage flocks of seaduck and divers found in inshore waters.

Geological

Foveran Links is an important part of the Sands of Forvie coastal area to which it is closely linked by a variety of environmental processes. Foveran Links, together with South Forvie, is a type example of what may be described as a normal sand dune system with a dynamic interchange of material between the frontal dunes and the extensive sand beach and spit complex at the mouth of the River Ythan. The site is of exceptional importance for the study of a wide variety of coastal landforms and processes and its value is enhanced by the availability of extensive research results in other disciplines which provide much additional and complementary evidence relevant to solving a broad range of gemorphological problems.

Annex 2 – Foveran Links SSSI – boundary in red

Foveran Links

Site of Special Scientific Interest

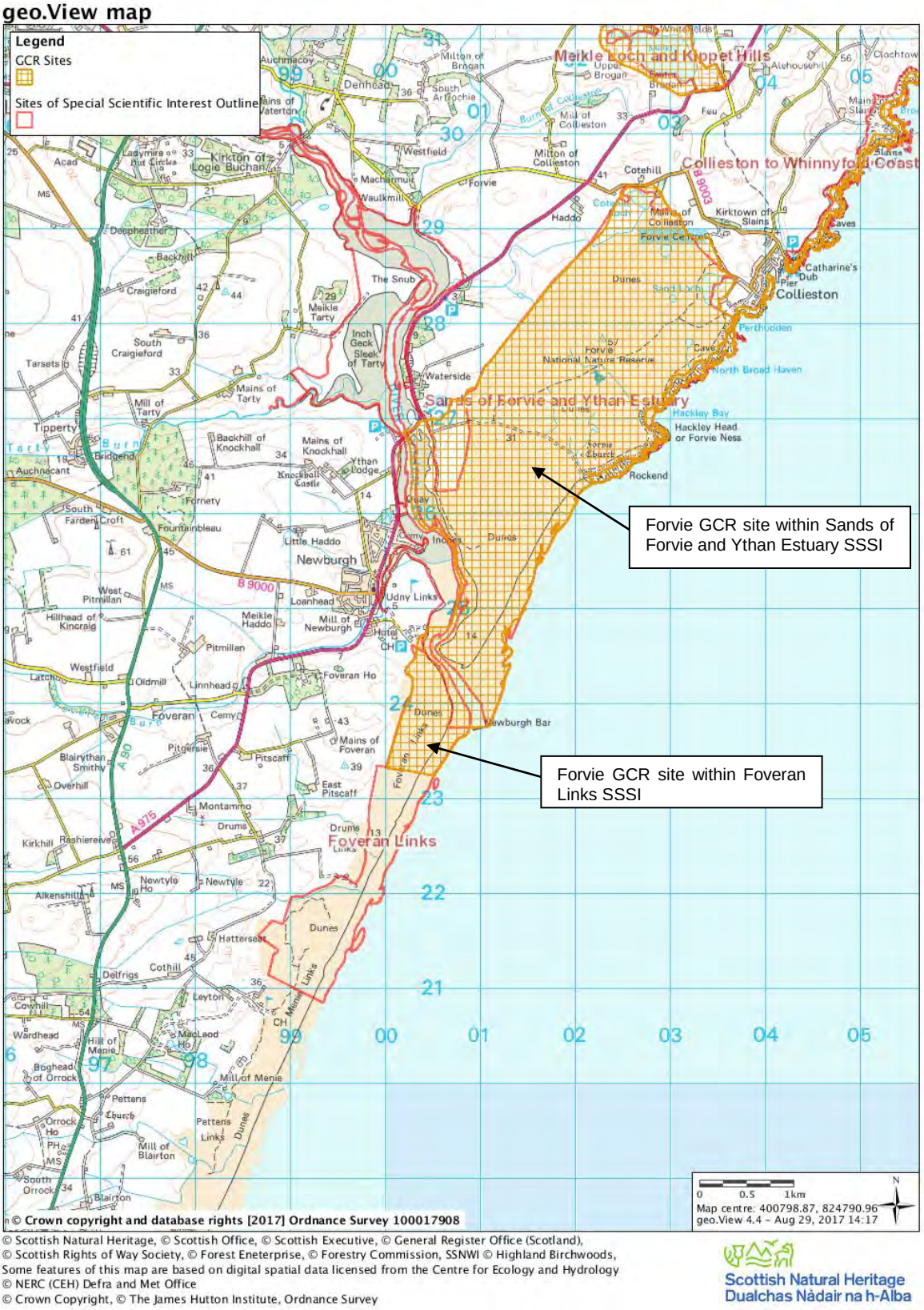
Site Code: 659

Site boundary

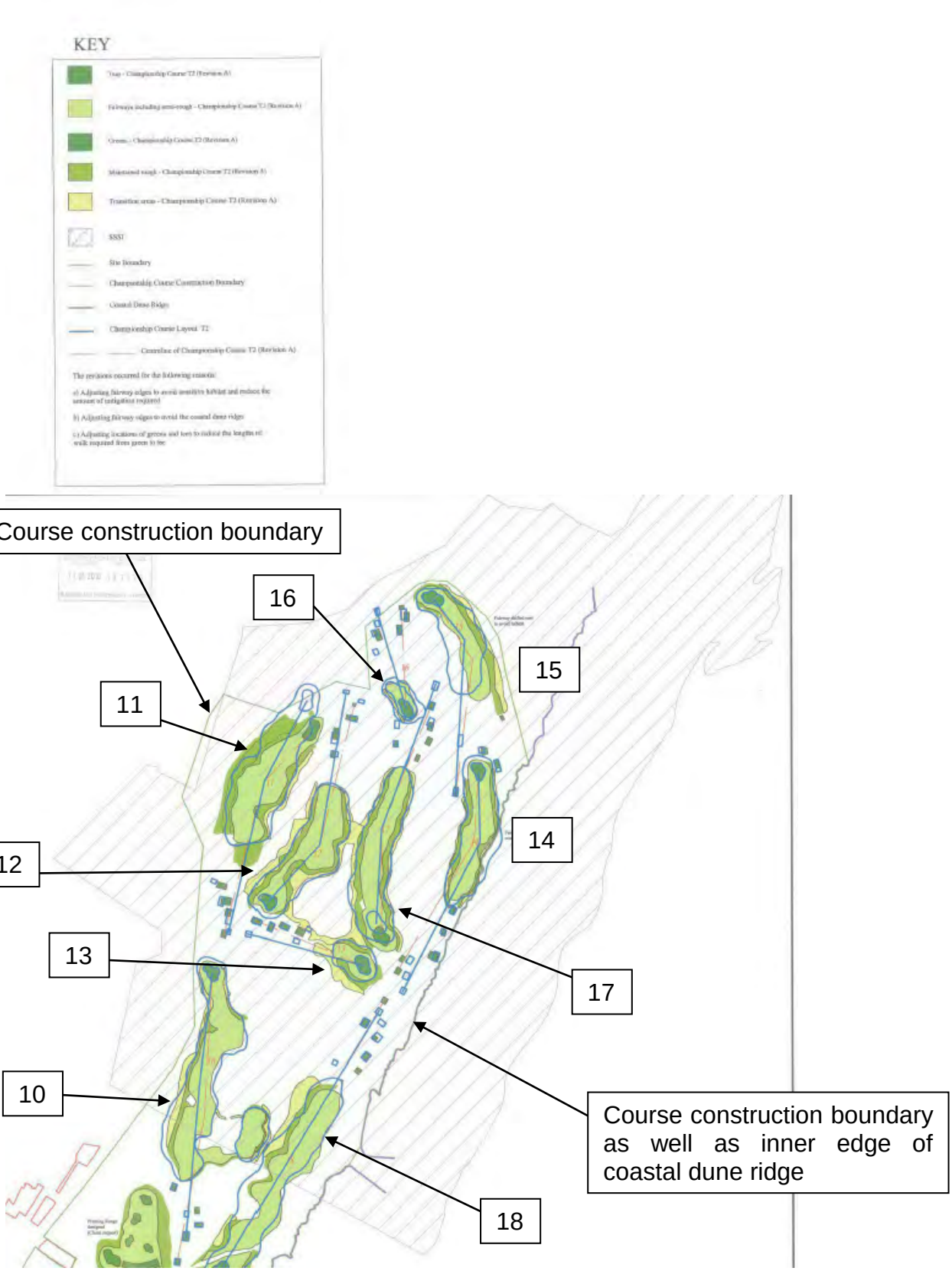
This is an updated representation of the notified site boundary. Any apparent small differences are due to changes to the OS backdrop.

Scale 1:18,000

Annex 3 - Map of Forvie GCR site



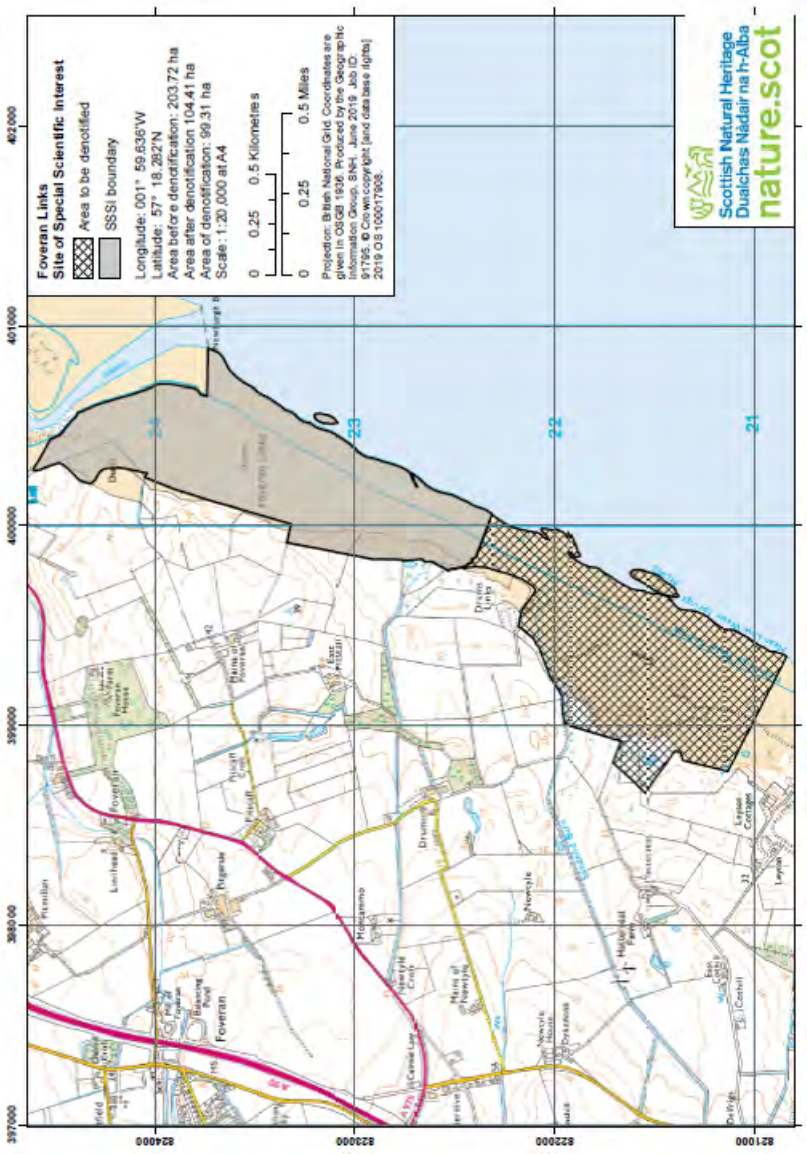
Annex 4 – Pre-construction plan of Menie Golf Course including Course Construction Boundary



Annex 5 – Menie Golf Course – planning application boundary; main remaining habitat fragments; land not owned by TIGLS

Annex 6 - Post-construction 2013 aerial photo of Menie Links Golf Course showing the location of the bare sand sheets (in yellow) prior to construction; SSSI boundary in red.

Annex 7 - Area of Foveran Links recommended for denotification – Option 3



Annex 8 - [redacted]

Annex 9 - Relevant sections of SSSI Selection Guidelines

1. Section 1.11 of the SSSI Selection Guidelines contains advice on defining boundaries of sand dune areas. Of relevance are the following sections:

   - 1.11.2.7: Normally those [sand dune] systems which have been identified … will be included in totality … However, there are many examples of dunes which have been modified by man's activity and where a decision is not always clear.

   - 1.11.2.8: Golf courses (links): These may not always be highly modified and may contain, particularly in the non-intensively managed 'roughs', substantial areas of important vegetation. Intensively managed greens, tees and fairways are usually of limited interest and should be excluded where they form a substantial proportion of the site.

   - 1.11.2.9: Mature, highly modified dune grassland: Normally areas towards the rear of dune systems which have been subject to fertiliser treatment or heavy grazing and eutrophication should not normally be incorporated within the site.

   - 1.11.2.13: Areas of dune rehabilitated by biological methods should normally be retained within existing sites and included in new ones. Artificial works, such as building of protective walls, may require deletion from existing sites … since all natural processes have presumably ceased to function.

2. Foveran Links SSSI only includes part of the large complex of sand dunes north of Aberdeen, but within this larger system are smaller cells in which sand may be recycled and the sand dunes are highly dynamic. Menie Links was one such system which extended as far north as the Sandend Burn; some 34 % of this system in the SSSI has been severely modified. Beyond this is a narrow stretch of dunes called Drums Links, separated by the Drums Burn from the most northerly system, Foveran Links (in its local sense) which is partially within Forvie GCR.

3. Menie Golf Course is distinctive because there is very little in the way of light unimproved rough outside the highly improved and fertilised fairways. Most of the rough is heavy rough consisting of marram grass *Ammophila*, and a significant proportion of this was previously mobile dunes which have been planted with marram. Elsewhere there are fragments of semi-natural habitat which have not been intensively modified but it is expected will alter over time without the dynamic processes which made the Menie Links part of the SSSI of particular interest.

4. There are some areas of dune grassland behind the golf course which show some signs of modification. However the retention of these areas is more likely to be questionable because the golf course has left these areas as isolated fragments.

5. There are no areas of 'rehabilitated' sand dune. The planting of marram grass was to stabilise bare or landscaped sand to protect the golf course, and therefore has actually been inimical to the natural processes which created the unusual and self-sustaining biodiversity in the SSSI. The retention of these planted areas is undesirable in the SSSI.

Annex 10 - Relevant sections of SNH Instruction Note on denotification procedures

1. The SNH Instruction Note on denotification procedures (B229084) states in Section 5 that 'you may only propose the de-notification of all or part of an SSSI when you can show that retention of that land cannot be otherwise justified. It could be that it supports none of the natural features for which that site is notified, or the features are still found on the land but at a level that is not now considered to be of special interest'.

   The Instruction Note specifies criteria for considering possible denotifications, of particular relevance being:

   5. (d) the natural feature has declined, [been] lost or damaged beyond reasonable expectations of recovery.

2. The Instruction Note states in Section 6:

   'Before deciding to denotify a site in whole or part, SNH must make a proper assessment of the circumstances and consider the options on a site by site basis. For example,

   - if there are other qualifying natural features on the same land, you might amend the citation and ORC list accordingly and maintain the SSSI boundary; or

   - if there is potential to restore the condition or status of the natural feature then, as appropriate, you might review the site management statement, ORC list and consents, consider offering a management agreement or encouraging entry to SRDP or any other similar scheme; or

   - if the natural feature in question is the only special interest for which the SSSI, or a part of it, is notified and there are no new qualifying interests on that land, you might decide to denotify the SSSI in whole or part'.

3. The Note goes on to state that denotification should be regarded as the final resort.

4. A number of these criteria and reasons for exclusion apply to the Menie section of Foveran Links and the question is how they should be applied.

Annex 11 Draft evaluation of qualifying natural features of Foveran Links SSSI for the Nature Conservation Review of site documentation

An earlier version of this table was prepared at an initial stage of the NCR Review of the SSSI prior to the golf course development (approved in draft by David Bale as Unit Manager) using the selection criteria in the Coastlands section of the SSSI Guidelines in the Gordon Area of Search.

Criterion	**Evaluation and comments on Foveran Links SSSI pre-golf course construction**	**Impact of golf course construction/ proposed boundary modifications on qualifying interests of Foveran Links SSSI (Option 3)**	**Does reduced Foveran Links SSSI still qualify?**	**Would reduced Foveran Links SSSI qualify in combination with Sands of Forvie and Ythan Estuary SSSI**
1.5.6.6 Dune system (excluding forest or enclosed grassland) exceeding 200 ha in area	Foveran Links SSSI is part of a large open coastal dune system, which extends north of Aberdeen to the Ythan Estuary, of which the current SSSI is 203 ha.	Reduction of SSSI by ca 99.6 ha (Foreshore 25.7 ha; Drums Links 6.7 ha; Menie Estate 67.2 ha) to 103.6 ha.	No	Yes, would form a sand dune area totalling ca. 815 ha on both sides of the Ythan; much of the area would be the Forvie GCR site.
1.5.6.7 Largest dune system with acidic, intermediate and calcareous substrates or representing different structural types	The wider dune system, of which Foveran Links SSSI is the largest part, is the largest sand dune system in Gordon AoS and incorporates both acidic and calcareous substrates. Foveran Links SSSI is the 2nd largest sand dune system in the AoS after the Sands of Forvie.	Reduces size of SSSI even further	No	Yes, since the unified SSSI would incorporate the best remaining examples of acidic and calcareous substrates in the Gordon AoS.

Criterion	Evaluation and comments on Foveran Links SSSI pre-golf course construction	Impact of golf course construction/ proposed boundary modifications on qualifying interests of Foveran Links SSSI (Option 3)	Does reduced Foveran Links SSSI still qualify?	Would reduced Foveran Links SSSI qualify in combination with Sands of Forvie and Ythan Estuary SSSI
1.5.6.8 Best example of any dune system containing plant sub-communities in Table 2b in the Selection Guidelines not represented by selection under 1.5.6.6 or 1.5.6.7 or occurring as better examples or in different	The 1984 citation states that the site contains communities which are absent from, or less well represented at, Forvie. The vegetation of the dune hollows and pasture, some of which are grazed, are especially interesting. Foveran Links SSSI dune system qualified as the best examples of one or more the following communities in the AoS:			

Criterion	Evaluation and comments on Foveran Links SSSI pre-golf course construction	Impact of golf course construction/ proposed boundary modifications on qualifying interests of Foveran Links SSSI (Option 3)	Does reduced Foveran Links SSSI still qualify?	Would reduced Foveran Links SSSI qualify in combination with Sands of Forvie and Ythan Estuary SSSI
combinations or relationships.	**<u>Mobile dune and sand</u>** SD6 mobile dune. Probably one of the best in Scotland.	Most of mobile dune has been lost from SSSI but some still remains in Foveran Links. Sands of Forvie probably has better examples.	No; better more extensive examples in Sands of Forvie SSSI	Yes. With the loss of the mobile dunes in Menie Links, would include the vast majority of the mobile dunes in the AoS as well as unify the whole of the mobile dune complex underpinned by the Forvie GCR site
	<u>Fixed dune habitats</u> SD7, SD8 and/or SD12 semi-fixed dune/dune grassland. It is not clear whether the site qualified as the best examples in the AoS of these communities, which are also found at Forvie.	Reduced areas of these habitats	Probably not	Yes; these habitats would unify the best remaining examples in the AoS in one SSSI
	<u>Dune slacks</u> The site was the best in Scotland for SD13 dune slacks	Some slacks remains in Foveran Links proper in the north of the site (ie north of Drums Links burn),	Probably, but significantly reduced in area	Yes, would provide added diversity to the types of slacks present on Forvie

Criterion	Evaluation and comments on Foveran Links SSSI pre-golf course construction	Impact of golf course construction/ proposed boundary modifications on qualifying interests of Foveran Links SSSI (Option 3)	Does reduced Foveran Links SSSI still qualify?	Would reduced Foveran Links SSSI qualify in combination with Sands of Forvie and Ythan Estuary SSSI
5.6.12 It is important that within this selection the best examples of the range of physiographic features, representing the different processes of dune formation, are included	The site is of importance for demonstrating the links between geomorphological processes and ecological interest, in particular the sand sheets at Menie, Foveran and Sandend Burn. Other key features included young dune slacks in the wake of the sand sheet (mainly Menie), deflation surfaces, emerged beach deposits (Foveran), emerged marine terraces (Menie), actively accreting embryo dunes (Foveran), mature dunes and butte dunes	Foveran Links still demonstrate these links and features. The golf course development has stabilised most of Menie and most of its features, including the main sand sheet, have been lost, and blow out corridors along the coastal ridge have been partially stabilised. Much of the 2nd dune ridge and some of the mature dunes and butte dunes remain, but the Sandend Burn sand sheet and the nearby emerged marine terrace have been reduced to remnants.	Probably	Yes

Criterion	**Evaluation and comments on Foveran Links SSSI pre-golf course construction**	**Impact of golf course construction/ proposed boundary modifications on qualifying interests of Foveran Links SSSI (Option 3)**	**Does reduced Foveran Links SSSI still qualify?**	**Would reduced Foveran Links SSSI qualify in combination with Sands of Forvie and Ythan Estuary SSSI**
Vascular Plant assemblage	The vascular plant assemblage would qualify due to the presence of: *Carex maritima* *Ophioglossum azoricum* *Rhadiola linoides* *Festuca arenaria*	These species would still be present in the SSSI, at least in the short term.	Probably	Yes

Annex 12 Process for partial denotification of Foveran Links SSSI and merger with Sands of Forvie SSSI

1. Informal consultation with the 3 land owners (already undertaken).
2. Notification by letter over the amendments to the SSSI boundary to owners and occupiers affected by the changes and to key public stakeholders, and public notices in at least one local newspaper at costs of ca. £250 and on www.tellmescotland.gov.uk.The consultation period would be at least 3 months
3. Objections by land owners on scientific grounds would be referred to Director of People and Nature in the first instance
4. A review of the SSSI documentation for the merged Foveran Links and Sands of Forvie SSSI and approval by T&G Unit Manager
5. Informal consultation with land owners in both SSSIs on merger
6. Confirmation or otherwise must take place within 12 months of the original notification to amend the boundary and would take place by letter and public notices
7. Notification by letter to merge Foveran Links and Sands of Forvie SSSIs to owners and occupiers and interested parties, and a public notice in a newspaper and on www.tellmescotland.gov.uk (which could take place at the same time as confirmation of denotification).
8. T&G staff would undertake most of the work with some input from GIG for maps. A consultation report would be submitted to Director of People and Nature if there were objections over the de-notification. The total cost for notices would be around £600.