

Welsh Water

**Cardiff Central Sewage Pumping
Station**

Habitat Regulations Assessment

Issue | 22 January 2020

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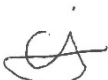
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1 Introduction

Ove Arup and Partners Ltd ('Arup') has been commissioned by Welsh Water, working as part of the Capital Delivery Alliance (CDA) to submit a Habitats Regulation Assessment (HRA) report in compliance with the requirements of the Conservation of Habitats and Species Regulations 2017 (as amended); hereafter referred to as the 'Habitats Regulations'.

Welsh Water are proposing improvement works at Cardiff Central Wastewater Treatment Works (WwTW) at approximate National Grid Reference (NGR) ST 20901 75508. The scheme aims to reduce the risk of environmental pollution incidents, localised short-term lower water quality/aesthetics, and early flooding at South Park underpass (in Cardiff) during storm events; which occur as a result of the tripping of the Pass Forward Flow (PFF) pumps in the Sewage Pumping Station (SPS), and silt in the emergency outfall pipeline. There is also a health and safety risk associated with an open outfall headwall (2.5m diameter) which currently provides public access to the outfall pipeline.

These works fall under Welsh Water's permitted development rights, and therefore planning permission is not required.

1.1 Purpose of this Document

This document has been prepared by Arup on behalf of Welsh Water, as a competent authority, in relation to the potential for effects on European Sites as required by Regulation 63(1) of the Habitats Regulations.

This document is to be submitted to Natural Resources Wales (NRW) as the statutory advisor for designated nature conservation sites in Wales to formally request their views on the assessment under Regulation 76 of the Habitats Regulations, and specifically whether they can concur with the conclusions.

1.2 Structure of this Report

This report uses the following structure:

- Section 2 provides information on the proposed works (the 'project') including the environmental baseline and a description of the development;
- Section 3 provides information on the data and methodology used in the assessment;
- Section 4 provides information on the European Sites that are considered within the assessment;
- Section 5 provides a screening assessment for the potential pathways for effects;
- Section 6 provides the Appropriate Assessment of the likelihood of significant effects occurring with mitigation measures and the residual effects;
- Section 7 provides proposals for monitoring; and

- Section 8 provides a conclusion.

1.3 The HRA Process

Regulation 63 of the Habitats Regulations requires a competent authority to make an ‘Appropriate Assessment’ of the implications of the plan or project for that site in view of its conservation objectives, before deciding to undertake or give consent for a plan or project which (a) is likely to have a significant effect on a European Site (either alone or in combination with other plans or project), and (b) is not directly connected with or necessary to the management of that site. In light of the conclusions of the assessment, the competent authority may proceed with or consent to the plan or project only after having ascertained that it will not adversely affect the integrity of the European Site.

All plans and projects should identify any possible effects early in the plan/project making process and then either alter the plan/project to avoid them or introduce mitigation measures to the point where no adverse effects remain. The ‘competent authority’ shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned, and if appropriate having obtained the opinion of the general public.

The assessment of a project under the Habitats Regulations can be split into several sections as shown in Appendix A¹; however, there are effectively four stages to the assessment as described below.

Stage 1 is the assessment of the likelihood of a plan or project having a significant effect on a European Site or its features. This is the trigger for the need for an Appropriate Assessment as set out in Regulation 63(1). The Appropriate Assessment (Stage 2) is the detailed consideration of the potential effects of the plan or project in relation to the conservation objectives for the European Site(s) to determine if there is likely to be an adverse effect on the integrity of the site (i.e. an effect that would compromise the site meeting its conservation objectives). Providing it can be demonstrated that with appropriate mitigation measures the plan or project would not give rise to an adverse effect on the integrity of a European Site, the plan or project can proceed.

Where this cannot be demonstrated or there is uncertainty, the assessment would then need to consider if there were any other alternatives to the plan or project (Stage 3) that would not give rise to adverse effects on the integrity of the European Site. If there are no alternatives, Stage 4 would then consider if there are any Imperative Reasons of Overriding Public Interest (IROPI), only at this stage can Compensatory Measures be considered. It is very unusual for plans or projects to be considered in Stages 3 or 4.

¹ Tyldesley, D. (2011). Assessing Projects Under the Habitats Directive: Guidance for Competent Authorities. Bangor: Countryside Council for Wales.

1.3.1 Consideration of Mitigation

With regards to recent case law (Coillte vs People Over Wind²) the inclusion of plainly established and uncontroversial mitigation during Stage 1 is no longer considered appropriate. Mitigation, as considered by the Centre Européen de Coopération Juridique (CECJ) in regard to the case law², is interpreted to mean measures that are intended to avoid or reduce the harmful effects of the envisaged project on the site concerned.

Consequently, any project which identifies an impact on a European Site and where avoidance and mitigation is applicable will need to address these measures during Stage 2 Appropriate Assessment.

² People over Wind, Case C323/17 European Court of Justice, 12th April 2018.

2 Project Description

2.1 Site Description

Cardiff Central WwTW is located on Tide Fields Road, Cardiff with the SPS located adjacent to Splott beach at the approximate NGR ST 20901 75508. Cardiff Central WwTW is located just north of the Cardiff Docks and approximately 2km south east of Cardiff town centre. The outfall chamber and pipe are located on Splott beach. The outfall pipe lies within an intertidal zone associated with the Severn Estuary.

The emergency outfall pipeline is approximately 60m in length and is buried underground. It runs south west from the pumping station (approximate NGR ST 20950 75555) to the outfall chamber (approximate NGR ST 20901 75507). The Motor Control Centre (MCC) panels are located within the control building to the west of the pumping station (approximate NGR ST 20915 75564).

2.2 Project Description

The project areas are outlined in Appendix B (Figure 1) and described below. The improvement works at Cardiff Central WwTW comprise three main elements. The first two elements aim to reduce the risk of environmental pollution incidents, localised short-term lower water quality/aesthetics, and early flooding at South Park underpass (in Cardiff) during storm events. These comprise:

1. Maintenance and reinstatement of the ventilation system in the existing MCC panel to resolve the overheating issue, which is causing the pumps to trip and hence inhibiting PFF pumping; and
2. Cleaning of the emergency outfall pipeline to remove the silt that is brought in by high tides.

The third element aims to remove the health and safety risk associated with public entry into the outfall pipe and comprises:

3. Replacement of the grille on the end of the outfall pipe.

The outfall grille replacement is proposed on the boundaries of the Severn Estuary/Môr Hafren European Marine Site (EMS) (comprising a Special Area of Conservation (SAC), Special Protection Area (SPA) and Ramsar Site) with remaining works adjacent to these sites. Cardiff Beech Woods SAC is also located within relative close proximity to the project.

Methodology

Construction methods for the improvement works are summarised below, with more detail, including figures, available within the initial construction Method Statement (MS) in Appendix E:

1. Maintenance and reinstatement of the ventilation system

All modifications to the MCC panels will likely be conducted within the MCC building.

2. Cleaning/De-silting

- Excavation/clearance of silt from the mouth of the existing outfall pipeline will be dictated by the tidal conditions and any works associated with the outfall will be carried out to suit the low tide conditions. Upon consulting the Tide Tables for Cardiff, a suitable working window will be established.
- Access on to the beach will be via the existing ramp from the upper path.
- A 20/30t tracked excavator will be situated on the bank to the east of the outfall outlet and will be used to clear approximately 1m depth of debris, silt and/or sediment from the mouth of the outlet to enable subsequent jetting/clearing to be removed from the opening and the associated outfall pipe. Excavated material will be deposited back onto the foreshore for natural dispersion.
- When the required material has been removed from the mouth of the outlet pipe, an access opening will need to be made into the top of the existing outfall flow diversion chamber.
- Scaffolding will be erected to the perimeter of the chamber to form edge protection for proposed works on the concrete cover slab of the chamber. This will be erected by a competent subcontractor strictly in accordance with their pre-approved risk assessment and method statement.
- To enable the jetting and cleaning of the outfall pipe from the pumping station back to the outfall chamber a section of the existing concrete slab will be temporarily removed.
- Temporary lifting accessories will be installed within the existing slab to enable the slab to be lifted off using the excavator and temporarily stored in a safe location on site for replacement on completion of the cleaning works. To facilitate safe lifting operations, the area that the excavator will sit will need to be levelled out using the machine and will be subsequently re-graded to the original profile on completion.
- All access to the outfall chamber and the outfall pipe will be strictly in accordance with Morgan Sindall confined space entry procedures. Works will be closely managed as cleaning works will not be possible during wet weather due to the likelihood of storm spills from the pumping station.
- The jetter will be inserted into the chamber through the new opening and used to jet sediment from the pipe towards and out of, the outfall location.
- It is proposed to utilise final effluent from Cardiff WWTW in the jetting equipment to mobilise the naturally deposited estuarine silts, which will be allowed to disperse in to the Severn Estuary from where they have originated.

3. Installation of New Outfall Grille

- When the outfall pipe has been sufficiently cleaned a new safety-grille is to be fabricated and fitted into the outfall opening.
- The new grille will be delivered to site and off-loaded as necessary. The attendant tracked excavator will then be used to lift the new grille into position complete with appropriate lifting equipment and strictly in accordance with the associated lift plan.

- When in position the grille will be fixed/secured in place as per the manufacturers recommendations. Access to drill and secure the grille will require the use of podium steps.

Access and Storage Areas

Access will be obtained to the site via the existing road through the Cardiff WwTW. Access onto Splott Beach will be via the existing ramp from the upper path.

A designated storage area will be fenced off using pedestrian barriers, for storage of all materials, plant and equipment. The exact location is yet to be established but will be clearly labelled on the site layout plan by Morgan Sindall.

All trees, hedges and shrubs within or adjacent to the site, will be protected from damage during construction work by the erection of 'Heras' fencing. Wherever possible the removal of any vegetation will be limited, and removal will only be carried out with the prior approval of the Safety, Health, Environment and Quality (SHEQ) Advisor and relevant authority, and following advice sought from a Suitably Qualified Ecologist (SQE).

The beach will be excavated locally to allow for access to the outfall ensuring only the minimum amount of ground is disturbed. As the beach outfall is tidal, the works will be below high-water level at times. Plant and construction materials will be removed from the beach at high tide to avoid damage or being dispersed by high water.

All activities will be carried out in daylight hours and will not require artificial lighting of any kind including any overnight lighting.

Re-fuelling Area:

The site will be established using a suitably sized bunded fuel bowser with spill kits available. Where practicable a designated diesel refuelling area will be established in the compound to minimise the risk of any spills around site. This designated refuelling area will be as far from any water course as is possible. If required a smaller towable bowser will be used to fill plant on Site. No refuelling operations will take place within 20m of the beach. A spill response kit will accompany the bowser at all times.

Waste and Recycling Skips

Waste and recycling skips/bins will be installed in accordance with the compound layout drawing and will be delineated by signage.

Chemicals

All chemicals that are used during the construction works must be evaluated for environmental risk and potential threat to the environment with emergency procedures in place to respond to and mitigate the effects of any incidents.

Designated storage areas for storage of all materials, plant and equipment (including any chemicals, oils and fuels) will be clearly labelled on the site layout plan.

All chemicals, oils and fuels must be stored within a purpose made container that is in good condition and clearly labelled with its contents. No refuelling operations will take place within 20m of the beach.

Chemicals will be stored in a secure Control of Substances Hazardous to Health (COSHH) store to which only authorised persons will have access.

Only remove enough chemical as required for the activity for which it is intended. Chemicals will be discharged over a drip tray when being used.

Only dispose of waste chemicals as per the manufacturer's recommendations. Oil booms and spill response kits will be kept on site to contain and clean up in the event of a spillage.

All plant will use bio-degradable oils.

Programme

Construction is programmed to commence in May 2020 lasting approximately six weeks.

2.3 Environmental Baseline

An Extended Phase 1 Habitat survey was carried out by two Arup SQE (Eloise Arif BSc (Hons) ACIEEM and Alex Kinsey BSc (Hons)) on the 5th February 2019 to cover the areas between and adjacent to the Cardiff Central outfall chamber, SPS and control building. The survey was carried out in accordance with standard Joint Nature Conservation Committee (JNCC) Extended Phase 1 Habitat survey methodology³. The survey results are denoted in Figure 2 in Appendix B, and described below.

A desk study search was also carried out, with data received from Aderyn⁴ for the South East Wales Biodiversity Records Centre (SEWBRc) on 26th October 2018. A summary of these results is included in Table 6 in Appendix D.

No Invasive Non-native Species (INNS)⁵ were identified during the Extended Phase 1 Habitat survey, however the survey was undertaken at a sub-optimal time of year for INNS identification and thus a pre-construction INNS survey is recommended. No records of INNS were provided from the desk study search.

The control building and SPS were located in the north-east of the survey area, which was dominated by tarmac and concrete hard standing, and a relatively large area of coniferous plantation. Other habitats present in the north-eastern part of the site were semi-improved neutral grassland, short perennial vegetation and dense scrub. Neither the control building nor the SPS were deemed suitable to

³ Joint Nature Conservation Committee (2010) Handbook for Phase 1 habitat survey – a technique for environmental audit

⁴ Aderyn is a Local Environmental Records Centres (LERC) Wales system, developed and maintained by the Biodiversity Information Service (BIS).

⁵ As listed on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended)

support roosting bats. The control building was however considered suitable to supporting nesting birds.

A metal security fence ran alongside the dense scrub in this area of the SPS. The fence was well maintained and secured at the bottom, and it was considered that mobile species such as badger and otter would not gain access underneath it.

The centre of the site, underneath which the outfall pipe runs, was a mosaic of dense scrub atop an earth bank, bare ground and short perennial vegetation. Mussel remains were recorded on the bare ground in this area, which could have been the feeding remains of either gulls or otter. No other evidence of other wintering bird species was noted during the survey, but the intertidal habitats were suitable for such species as gadwall (*Anas Strepera*), greater white-fronted goose (*Anser albifrons*), dunlin (*Calidris alpine*), Bewick's swan (*Cygnus columbianus subsp. Bewickii*), common shelduck (*Tadorna tadorna*), and common redshank (*Tringa tetanus*), all of which are overwintering features of the Severn Estuary SPA and Ramsar site. No habitat suitable for resting otter was identified, although otter could use the site for foraging and/or commuting.

The outfall chamber was located in the south-west of the survey area which comprised of intertidal habitats (mud/sand and shingles/cobbles), dense scrub, scattered broad-leaved trees and more tarmac hardstanding. The outfall chamber appeared well sealed and was not considered suitable to support nesting birds or roosting bats. The only openings to the building were the three vent holes and the outfall pipe itself.

There may be potential for protected fish species such as sea lamprey (*Petromyzon marinus*), river lamprey (*Lampetra fluviatilis*), and twaite shad (*Alosa fallax*) within the intertidal habitats at high tide, all of which are features of the Severn Estuary SAC and Ramsar site.

Figure 3 in Appendix B identifies the European Sites within 10km of the project. These sites are described in detail in Tables 1 to 4.

3 Guidance and Methodology

This section sets out the guidance and evidence base used in assessing the potential effects of the project.

3.1 Guidance and Policy

This information has been informed by the following guidance and policy documents:

- Planning Policy Wales - Technical Advice Note (TAN) 5: Nature Conservation and Planning⁶;
- The Habitats Regulations Assessment Handbook, DTA Publications Ltd⁷; and
- Tyldesley, D. and Chapman, C. 2018. People Over Wind – some Implications of the Judgment. The Habitat Regulations Journal, Issue 10, pp. 19 – 23.

This guidance is intended to improve understanding of how projects are regulated under the Habitats Directive. This guidance draws on experience throughout Britain and on case law in Britain and Europe.

3.2 Desk Study Information

In addition to the guidance noted above, a number of websites were used to gather information on the European Sites in order to inform this assessment, in particular, the Management Plans for European Sites and Regulation 37 information. Websites used include:

- Natural Resources Wales (NRW) (and legacy body Countryside Council for Wales (CCW)⁸) website⁹;
- Natural England (NE) website¹⁰;
- Magic (Multi-Agency Geographic Information for the Countryside) website¹¹;
- JNCC website¹²; and
- Aderyn⁴.

⁶ Welsh Government. (2009). Planning Policy Wales - Technical Advice Note 5: Nature Conservation and Planning. Cardiff: Welsh Government.

⁷ Tyldesley, D. and Chapman, C. (2013) The Habitats Regulations Assessment Handbook. Nov 2019 edition. UK, DTA Publications Ltd <https://www.dtapublications.co.uk/>

⁸ CCW has been amalgamated with the Environment Agency Wales and the Forestry Commission in Wales to form Natural Resources Wales.

⁹ Natural Resources Wales Find Protected Areas of Land and Seas <https://naturalresources.wales/guidance-and-advice/environmental-topics/wildlife-and-biodiversity/find-protected-areas-of-land-and-seas/designated-sites/?lang=en>

¹⁰ Natural England Access to Evidence <http://publications.naturalengland.org.uk/>

¹¹ MAGIC. (2014). Magic interactive Mapping Application.

<http://www.magic.gov.uk/MagicMap.aspx>

¹² JNCC Website <https://jncc.gov.uk/>

The documents obtained provide the main elements of NRW's management plans for European Sites along with the Conservation Objectives for the features. The features will be considered to be in Favourable Conservation Status only when the conservation objectives are being met. These objectives therefore provide an indication of the type of effects which could affect the features of European Site. An effect which could affect the ability of a site or feature to meet its objective could be considered to be an adverse effect on the integrity of the European Site concerned.

3.3 Habitats Regulations Assessment Methodology

To understand the potential implications for European Sites from the project it is necessary to identify those sites that are located close to the project or are linked by pathways such as hydrological connections.

All European Sites and European Marine Sites within 10km of the project were identified using Geographic Information System data from datasets downloaded from the JNCC, Magic and NRW.

3.3.1 Understanding Qualifying Interests and Conservation Objectives

For each of the sites identified, the qualifying features were established and the conservation objectives for each feature were obtained. Information was also sought to understand the potential vulnerability of the features to any effects that might arise from the project.

3.3.2 Identification of the Potential Effects of the Project

Any potential pathways for effect on European Sites resulting from the project were identified prior to consideration of best practice procedures (for example, Guidelines for Pollution Prevention and Construction Industry Research and Information Association (CIRIA) guidance) or the integration of any mitigation measures.

3.3.3 Identification of Plans or Projects Considered for In-Combination Effects

An 'in-combination' assessment is required where the project may have an effect on a European Site, but on its own the effects would not be significant. The potential effects of the project should be considered in-combination with other plans or projects that similarly may have an effect, but where on their own those effects would not be significant. The combined effects may therefore become significant.

Details of other plans and projects which are currently proposed or consented within the vicinity of the European Sites identified were obtained from the local

planning authority website¹³ to inform the in-combination assessment of the project.

3.3.4 Consideration of the Significance of Potential Effects

The significance of potential effects was assessed in the absence of any avoidance and/or mitigation measures. The assessment has been made with awareness of the conservation objectives for the features of the European Sites, although as stated in the relevant guidance the assessment of the project against the conservation objectives is not required until the Appropriate Assessment stage of the HRA process. In the assessment of the significance of effects, professional judgement was applied using the following criteria, as sufficient information about the elements and interests is often unavailable:

- The vulnerability/sensitivity of the receiving environment/features of interest;
- When the risk of effects is likely to occur (e.g. construction and/or operation);
- The likely geographical extent of the effects; and
- Likelihood of significant effects (e.g. those above negligible in magnitude) occurring based on previous experience with similar elements, where available.

Where there was not enough information about the risk of qualifying interest being present, or of the risk of effects, the assessment used the precautionary principle to inform the judgement. The precautionary principle has been applied to ensure that any assessment errs on the side of caution, without being overly cautious. This principle means that the conservation objectives should prevail where there is uncertainty or that harmful effects will be assumed in the absence of evidence to the contrary.

3.4 Limitations

Information provided by third parties, including publicly available information and databases, is considered correct at the time of publication. Due to the dynamic nature of the environment, conditions may change in the period between the preparation of this report, and the construction and operation of the project.

The HRA has been undertaken in as detailed a way as possible, using all available data sources where they exist. However, the conclusions drawn from this is necessarily limited by the age, type, coverage and availability of data. Any uncertainties and the limitations of the assessment process are acknowledged and highlighted.

Recommendations for mitigation measures to address the potential adverse effects on European Site integrity identified by this report are also based on the information available at the time of the assessment.

¹³ Cardiff Council Planning Online (accessed 25th November 2019)
<https://planningonline.cardiff.gov.uk/online-applications/>

4 European Sites Potentially Affected by the Proposal

4.1 Identification of European Sites

Figure 3 within Appendix B shows the location of the project in relation to European Sites within 10km of the improvement works.

The European Sites identified within 10km of the works are as follows (distances and direction are measured as a straight line from the closest edge of the project to the closest edge of the European Site):

- Severn Estuary SAC (partially within project boundary);
- Severn Estuary SPA (partially within project boundary);
- Severn Estuary Ramsar site (partially within project boundary); and
- Cardiff Beech Woods SAC (9.9km north west).

The features for which the identified European Sites have been designated are summarised in Table 1 to Table 4. The Natura 2000 Standard Data Forms, as well as other information sheets for the sites can be found in Appendix C.

Severn Estuary SAC

Table 1: Characteristics of the Severn Estuary SAC

Name of European Site and its EU Code	Severn Estuary/Môr Hafren SAC EU Site Code UK0013030
Location and distance of the European Site from the project	Located in the Dorset and Somerset, East Wales, Extra-Regio, Gloucestershire, Wiltshire and Bristol/Bath area Unitary Authority, central NGR ST321748, falling partially within project boundary.
European Site size	73714.11 ha
Key features of the European Site	Annex I habitats that are a primary reason for designation: • Estuaries; • Mudflats and sandflats not covered by seawater at low tide; and • Atlantic salt meadows (<i>Glauco-puccinellietalia maritimae</i>). Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site: • Sandbanks which are slightly covered by sea water all the time; and • Reefs. Annex II species that are a primary reason for selection of this site: • Sea lamprey • River lamprey • Twaite shad
Vulnerability of the European Site	The Natura 2000 site Standard Data Form states that the following threats and pressures have a high impact on the SAC: • Other urbanisation, industrial and similar activities;

	• Changes in abiotic conditions; • Human induced changes in hydraulic conditions; • Outdoor sports and leisure activities, recreational activities; and • Cultivation.
European Site conservation objectives	The Conservation Objectives for the Severn Estuary SAC are to maintain the key features in favourable condition. The features will be considered to be in favourable condition when certain conditions are met. These conditions are extensive and specific to each feature. The full conditions can be found within Section 6.1 and Appendix C ¹⁴ .

Severn Estuary SPA

Table 2: Characteristics of the Severn Estuary SPA

Name of European Site and its EU Code	Severn Estuary/Môr Hafren SPA EU Site Code UK9015022
Location and distance of the European Site from the project	Located in the Extra-Regio, West Wales and The Valleys Unitary Authority, central NGR SH629728, falling partially within project boundary.
European Site size	24487.91 ha
Key features of the European Site	The site is designated for regularly supporting the following overwintering bird species: • Gadwall • Greater white-fronted goose • Dunlin • Bewick's swan • Common shelduck • Common redshank
Vulnerability of the European Site	The conservation of the site features is dependent on the tidal regime. The range is the second highest in the world and the scouring of the seabed and strong tidal streams result in natural erosion of the habitats. The Estuary is therefore vulnerable to large scale interference, including human actions. These include land-claim, aggregate extraction/dredging, physical developments such as barrage construction flood defences, pollution (industrial, oil spillage), eutrophication and tourism-based activities and disturbance.
European Site conservation objectives	The Conservation Objectives for the Severn Estuary SPA are to maintain the key features in favourable condition. The features will be considered to be in favourable condition when certain conditions are met. These conditions are extensive and specific to each feature. The full conditions can be found within Section 6.2 and Appendix C ¹⁴ .

¹⁴ Severn Estuary SAC, SPA and Ramsar Site: Regulation 33 Advice from CCW and Natural England, June 2009

Severn Estuary Ramsar site

Table 3 Characteristics of the Severn Estuary Ramsar site

Name of European Site and its EU Code	Severn Estuary/Môr Hafren Ramsar site EU Site Code UK11081
Location and distance of the European Site from the project	Located in the Extra-Regio, West Wales and The Valleys Unitary Authority, central NGR SH629728, falling partially within project boundary.
European Site size	24662.98 ha
Key features of the European Site	The site is designated for the following Ramsar criteria: • Ramsar criterion 1 – Due to immense tidal range (second-largest in world), this affects both the physical environment and biological communities, moulding the Annex I habitat features of subtidal sandbanks, estuaries, intertidal mudflats and sandflats, and Atlantic salt meadows. • Ramsar criterion 3 – Due to unusual estuarine communities, reduced diversity and high productivity. • Ramsar criterion 4 – This site is important for the run of migratory fish between sea and river via Estuary. Species include Salmon (<i>Salmo salar</i>), sea trout (<i>Salmo trutta</i>), sea lamprey, river lamprey, allis shad (<i>Alosa alosa</i>), twaite shad, and eel (<i>Anguilla anguilla</i>). It is also of particular importance for migratory birds during spring and autumn. • Ramsar criterion 8 – The fish of the whole estuarine and river system is one of the most diverse in Britain, with over 110 species recorded. Salmon, sea trout, sea lamprey, river lamprey, allis shad, twaite shad, and eel use the Severn Estuary as a key migration route to their spawning grounds in the many tributaries that flow into the Estuary. The site is important as a feeding and nursery ground for many fish species particularly allis shad and twaite shad which feed on mysid shrimps in the salt wedge. • Ramsar criterion 5 – Internationally important assemblage of waterfowl. The species include (w = wintering and p = passage): Bewick's swan (w), greater white-fronted goose (w), shelduck (w), dunlin (w, p) redshank (w, p), gadwall (w), ringed plover (w, p), whimbrel (p), teal (w), pintail (w), wigeon (w), pochard (w), tufted duck (w), grey plover (w), curlew (w) and spotted redshank (w). This feature incorporates: – Waterfowl which contribute to the total peak winter count; – The below internationally important wintering populations; – The migratory passage species; and – The nationally important populations. • Ramsar criterion 6 – Species/populations occurring at levels of international importance. Species with peak counts in winter: – Bewick's swan, NW Europe, 229 individuals, representing an average of 2.8% of the GB population (5-year peak mean 1998/9- 2002/3); – Greater white-fronted goose, NW Europe, 2076 individuals, representing an average of 35.8% of the GB population (5-year peak mean for 1996/7-2000/01);

	- Common shelduck, NW Europe, 3223 individuals, representing an average of 1% of the population (5-year peak mean 1998/9- 2002/3); - Gadwall, NW Europe, 241 individuals, representing an average of 1.4% of the GB population (5-year peak mean 1998/9- 2002/3); - Dunlin, W Siberia/W Europe, 25082 individuals, representing an average of 1.8% of the population (5-year peak mean 1998/9-2002/3); and - Common redshank, 2616 individuals, representing an average of 1% of the population (5-year peak mean 1998/9- 2002/3).
Vulnerability of the European Site	The factors (past, present or potential) adversely affecting the site's ecological character including dredging, erosion and recreational/tourism disturbance.
European Site conservation objectives	The Conservation Objectives for the Severn Estuary Ramsar site are to maintain the key features in favourable condition. The features will be considered to be in favourable condition when certain conditions are met. These conditions are extensive and specific to each feature. The full conditions can be found within Section 6.3 and Appendix C ¹⁴ .

Cardiff Beech Woods SAC

Table 4: Characteristics of the Cardiff Beech Woods SAC

Name of European Site and its EU Code	Cardiff Beech Woods SAC EU Site Code UK0030109
Location and distance of the European Site from the project	Located in the East Wales Unitary Authority, central NGR ST118824, lying approximately 9.9km north west of the project.
European Site size	114.45 ha
Key features of the European Site	Annex I habitats that are a primary reason for designation: • <i>Asperulo-Fagetum</i> beech forests. Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site: • <i>Tilio-Acerion</i> forests of slopes, screes and ravines.
Vulnerability of the European Site	The Natura 2000 site Standard Data Form states that the following threats and pressures have a high impact on the SAC: • Interspecific floral relations; • Invasive non-native species; and • Outdoor sports and leisure activities, recreational activities.
European Site conservation objectives	The vision for both features of the SAC are for them to be in favourable conservation status, where all of the following conditions are satisfied: • The existing <i>Asperulo-fagetum</i> beech forest and <i>Tilio-acerion</i> forest will be maintained; • At least 95% of canopy forming trees will be locally native species (sycamore included) such as beech, ash and oak, with some areas dominated by beech;

	• The tree canopy will not be completely closed; approximately 10% of the canopy will include a dynamic shifting pattern of gaps encouraging natural regeneration of tree species of all ages; • Dead wood, standing and fallen, will be maintained where possible to provide habitat for invertebrates, fungi and other woodland species; • There are pockets of ground flora across the site, comprising species typical of lime-rich beech wood, including indicators of ancient woodland such as wood anemone, ramsons and sanicle; • There is little evidence of browsing or squirrel damage to trees; • Recreational use of the site will continue to be managed so it does not damage the wildlife interest of the site; and • All factors affecting the achievement of these conditions are under control.
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4.2 Identification of Other Plans and Projects

The following planning applications were identified near the project. This list is correct at the time of writing (25th November 2019) and includes those applications from the last six months and within a 500m radius from the project boundary:

- Planning Application A/19/00075/MNR (Full): Replacement of an existing 96-sheet advertisement display with an illuminated 48-sheet digital advertisement display
- Planning Application 19/02642/MJR (Variation of conditions): Variation of Condition 3 to increase part of the internal fence height and variation of Condition 5 to amend the approved plan layout in respect of previous permission reference 14/01870/DCI (which was granted in 2014 and comprised the redevelopment of the site to a metal recycling centre (Sui Generis) and installation of necessary plant and ancillary developments).

5 Screening Assessment

5.1 Potential Effects of the Project

During construction, there is predicted to be a potential pathway for effect on the European Sites identified in Section 4.1 above. The potential pathway for effect on each site is in the form of:

- Habitat degradation through water pollution or sedimentation;
- Physical disturbance of habitats;
- Spread of Schedule 9 INNS;
- Disturbance/displacement to fauna e.g. from visual impact, noise, lighting and/or vibrations; and
- Mortality/injury of individuals.

These potential effects are considered in more detail in Table 5 and in subsequent sections. There is not predicted to be an operational effect on any European Site as all discharges will remain as existing or reduce, thus improving the water quality.

Table 5: Potential construction effects of the project on European Sites and their features within 10km

Potential Effect	Features of European Sites					
	Severn Estuary SAC		Severn Estuary SPA	Severn Estuary Ramsar site		Cardiff Beech Woods SAC
	Annex I habitats	Annex II fish species	Annex II bird species	Criteria 1 - Annex I habitats; 3 - Estuarine communities; 4 - Migratory birds and fish; 5 - Waterfowl assemblages; and 8 - Diverse fish species	Criterion 6: Annex II bird species	Annex I habitats
Water pollution/sedimentation	Pathway for effect	Pathway for effect	No pathway for effect – temporal separation	Pathway for effect	No pathway for effect – temporal separation	No pathway for effect – spatial separation
Spread of INNS						
Physical disturbance of habitats						
Disturbance / displacement to faunal species	N/A					

Potential Effect	Features of European Sites					
	Severn Estuary SAC		Severn Estuary SPA	Severn Estuary Ramsar site		Cardiff Beech Woods SAC
	Annex I habitats	Annex II fish species	Annex II bird species	Criteria 1 - Annex I habitats; 3 - Estuarine communities; 4 - Migratory birds and fish; 5 - Waterfowl assemblages; and 8 - Diverse fish species	Criterion 6: Annex II bird species	Annex I habitats
Mortality / injury of individuals						

5.2 Consideration of Effects and Significance

Both the Severn Estuary SAC and Severn Estuary Ramsar site have been screened into the assessment due to the pathway for effect arising from lying partially within the project boundary. For the purposes of this assessment it is concluded that in the absence of mitigation (as confirmed by Coillte vs People Over Wind judgement) where pathways for effects are present, these are considered to have the potential to cause significant effects and therefore an Appropriate Assessment is required for these sites.

The Severn Estuary SPA has been scoped out of the assessment as the qualifying features of the SPA are designated over the winter only. Therefore, there is a temporal separation between the project (commencing in May 2020) and the defined wintering period within which the qualifying features are protected (October to March (inclusive)).

Cardiff Beech Woods SAC has also been scoped out of the assessment. It is considered that the spatial separation between the works and this European Site is sufficient to avoid any potential impact pathways.

6 Appropriate Assessment

6.1 Severn Estuary SAC

6.1.1 Annex I Habitats

The Annex I habitats present within the Severn Estuary SAC include estuaries, mudflats and sandflats not covered by seawater at low tide, Atlantic salt meadows (*Glauco-puccinellietalia maritimae*), sandbanks which are slightly covered by sea water all the time, and reefs. These habitat features are distributed throughout the SAC with features overlapping in some locations. The only feature to occupy the entire SAC is the 'estuaries' feature. The habitat features which lie within the project boundary include estuaries, and intertidal mudflats and sandflats. The other habitat features of Atlantic salt meadows, subtidal sandbanks and reefs all lie at least 1.5km outside of the project boundary.

6.1.1.1 Conservation Objectives

The habitat features of Severn Estuary SAC are potentially vulnerable to the effects of water quality changes from pollutants, the spread of INNS via construction machinery or construction workers' footwear, or physical disturbance of habitats by construction vehicles. The conservation objectives for the habitat features state that the habitat features will be considered to be in favourable conservation status when the following are met for each habitat feature:

Estuaries

- The total extent of the Estuary is maintained;
- The characteristic physical form (tidal prism/cross sectional area) and flow (tidal regime) of the Estuary is maintained;
- The characteristic range and relative proportions of sediment sizes and sediment budget within the site is maintained;
- The extent, variety and spatial distribution of estuarine habitat communities within the site is maintained;
- The extent, variety, spatial distribution and community composition of hard substrate habitats and their notable communities is maintained;
- The abundance of the notable estuarine species assemblages is maintained or increased;
- The physico-chemical characteristics of the water column support the ecological objectives described above;
- Toxic contaminants in water column and sediment are below levels which would pose a risk to the ecological objectives described above; and
- Airborne nutrient and contaminant loads are below levels which would pose a risk to the ecological objectives described above.

Intertidal Mudflats and Sandflats

- The total extent of the mudflats and sandflats feature is maintained;
- The variety and extent of individual mudflats and sandflats communities within the site is maintained;
- The distribution of individual mudflats and sandflats communities within the site is maintained;
- The community composition of the mudflats and sandflats feature within the site is maintained;
- The topography of the intertidal flats and the morphology (dynamic processes of sediment movement and channel migration across the flats) are maintained.

Atlantic Salt Meadows

- The total extent of Atlantic salt meadow and associated transitional vegetation communities within the site is maintained;
- The extent and distribution of the individual Atlantic salt meadow and associated transitional vegetation communities within the site is maintained;
- The zonation of Atlantic salt meadow vegetation communities and their associated transitions to other Estuary habitats is maintained;
- The relative abundance of the typical species of the Atlantic salt meadow and associated transitional vegetation communities is maintained;
- The abundance of the notable species of the Atlantic salt meadow and associated transitional vegetation communities is maintained.
- The structural variation of the salt marsh sward (resulting from grazing) is maintained within limits sufficient to satisfy the requirements of the conditions above and the requirements of the Ramsar and SPA features;
- The characteristic stepped morphology of the salt marshes and associated creeks, pills, drainage ditches and pans, and the estuarine processes that enable their development, is maintained; and
- Any areas of *Spartina anglica* salt marsh (SM6) are capable of developing naturally into other saltmarsh communities.

Subtidal Sandbanks

- The total extent of the subtidal sandbanks within the site is maintained;
- The extent and distribution of the individual subtidal sandbank communities within the site is maintained;
- The community composition of the subtidal sandbank feature within the site is maintained;
- The variety and distribution of sediment types across the subtidal sandbank feature is maintained; and
- The gross morphology (depth, distribution and profile) of the subtidal sandbank feature within the site is maintained.

Reefs

- The total extent and distribution of *Sabellaria* reef is maintained;
- The community composition of the *Sabellaria* reef is maintained;

- The full range of different age structures of *Sabellaria* reef are present; and
- The physical and ecological processes necessary to support *Sabellaria* reef are maintained.

6.1.2 Annex II Species

The Annex II species present within the Severn Estuary SAC include sea lamprey, river lamprey and twaite shad. There are currently no descriptions of these species' distributions within the SAC on the JNCC website, but the Severn Estuary area is considered to be of grade A/B quality for these species¹⁵.

Sea lamprey, river lamprey and twaite shad all spawn in freshwater streams and rivers. In the spring, adult sea lamprey and twaite shad return to rivers from the sea to spawn, usually between April and June^{16;17}. River lamprey migrate up the rivers during the winter and start to spawn in April/May¹⁷. At the time of the works, all individuals of these species that have reached maturity will have migrated upstream to spawn, and as such will not be impacted. However, a small number of individuals yet to reach maturity may remain in the Estuary, feeding within/adjacent to the project boundary at high tide.

6.1.2.1 Conservation Objectives

The Annex II species within the Severn Estuary SAC are potentially vulnerable to habitat damage and mortality/injury due to water quality changes from pollutants, the spread of INNS via construction machinery or construction workers' footwear, or physical disturbance of migration or feeding habitats by construction vehicles. There is also the potential for disturbance/displacement of Annex II species.

The conservation objectives for the Annex II species state that they will be considered to be in favourable conservation status when the following conditions are met for each:

- The migratory passage of both adult and juvenile sea lamprey, river lamprey and twaite shad through the Severn Estuary between the Bristol Channel and any of their spawning rivers is not obstructed or impeded by physical barriers, changes in flows, or poor water quality;
- The size of the sea lamprey, river lamprey, and twaite shad populations in the Severn Estuary and the rivers which drain into it, are at least maintained and are at a level that is sustainable in the long term;

¹⁵ Grade A = Outstanding example of the feature in a European context.

Grade B = Excellent example of the feature, significantly above the threshold for SSSI/ASSI notification but of somewhat lower value than grade A sites.

Sea lamprey distribution: <https://sac.jncc.gov.uk/species/S1095/map> (Accessed 10/12/2019)

River lamprey distribution: <https://sac.jncc.gov.uk/species/S1099/map> (Accessed 10/12/2019)

Twaite shad distribution: <https://sac.jncc.gov.uk/species/S1103/map> (Accessed 10/12/2019)

¹⁶ Maitland, P.S., and Hatton-Ellis, T.W. (2003) Ecology of the Allis and Twaite Shad. Conserving Natura 2000 Rivers Ecology Series No. 3. English Nature, Peterborough.

¹⁷ Maitland, P.S. (2003). Ecology of the River, Brook and Sea Lamprey. Conserving Natura 2000 Rivers Ecology Series No. 5. English Nature, Peterborough.

- The abundance of prey species forming the sea lamprey's, river lamprey's and twaite shad's food resource within the Estuary (in particular, at the salt wedge for twaite shad), are maintained; and
- Toxic contaminants in the water column and sediment are below levels which would pose a risk to the ecological objectives described above.

6.1.3 Potential Effects

6.1.3.1 Water Pollution

In the absence of any avoidance and/or mitigation measures, there is the potential for construction activities to result in a pollution incident (e.g. from disconnected pipework or machinery) within the Severn Estuary SAC (which the project lies partially within). Annex I habitats that lie within the project boundary that may be subject to these negative effects include estuaries, and intertidal mudflats and sandflats. There is also the potential to negatively impact the habitats on which the qualifying fish species for Severn Estuary SAC rely.

Given the relatively short construction period and the small zone of impact to nearby habitats (likely to be <1% of total habitat), such potential impacts to habitats are therefore considered to be of minor significance. Furthermore, in its current state the outfall pipe is leaking sewage during storm water events. The project will improve the condition of the pipe and the outfall chamber, thus reducing the risk of pollution incidents as compared to the current situation. However, given the potential for a pollution event on site, mitigation measures are proposed in subsequent sections.

6.1.3.2 Spread of INNS

No records of INNS were provided during the desk study search, and no INNS were identified during the field survey. However, the field survey was undertaken at a sub-optimal time of year for INNS identification and as such, a pre-construction INNS survey is recommended to be undertaken in spring, prior to commencement of the works. If INNS are found to be present within or immediately adjacent to the project boundary, they may be spread elsewhere via construction worker's machinery and/or footwear, in the absence of any avoidance and/or mitigation measures.

If INNS are allowed to spread and proliferate within the Severn Estuary SAC, it is considered that this could give rise to a significant negative effect on the qualifying habitat features of these European Sites, as well as on the habitats on which the qualifying fish species for Severn Estuary SAC rely.

6.1.3.3 Physical Disturbance of Habitats

A 20/30t tracked excavator is required to clear debris, silt and/or sediment from the mouth of the outfall, to lift the slab from the outfall chamber to allow access for cleaning, and to lift the new grille in to position. To facilitate safe lifting operations, the area that the excavator will sit will need to be levelled out using

the machine and will be subsequently re-graded to the original profile on completion.

This means that direct impacts to the Annex I habitats within the project boundary (estuaries, and intertidal mudflats and sandflats), and to habitats upon which Annex II fish species may rely are unavoidable. However, the area of Severn Estuary SAC that lies within the project boundary is 0.01ha, which equates to just 0.00001% of the overall area of the SAC. Furthermore, the recoverability of the mudflats and sandflats feature is high. All material excavated from the mouth of the outfall will be deposited back onto the foreshore where it originated for natural dispersion. The majority of the impacted Annex I habitat infauna are both horizontally and/or vertically mobile such that they will move during a tidal cycle and colonise new areas to exploit resources or avoid competition.

With regards to indirect impacts on Annex II fish species, as described above, only feeding juveniles will still be present within the Estuary at the time of the works. Foraging twaite shad appear to prefer water that is 10 to 20m deep and have been recorded at depths of 200 to 300m¹⁶. Information regarding depth preferences of lamprey is limited, however, all works on the beach will be carried out at low tide. As such, twaite shad, river lamprey and sea lamprey are all considered to be absent from the areas within and immediately adjacent to the project boundary during the works. Annex II fish species will therefore not be impacted by disturbance to habitats.

As such, additional mitigation is not required as physical habitat disturbance due to the works will not lead to an adverse effect on the integrity of the SAC.

6.1.3.4 Disturbance/Displacement to Faunal Species

Disturbance to juvenile feeding Annex II fish species described above could arise from construction noise and vibration e.g. during movement of machinery around the site and during the cleaning of the outfall pipe. However, this is likely to be minor as no piling or percussive works are anticipated on site, no artificial lighting is proposed at any time, and no works will be carried out on the beach at high tide.

As described above, qualifying fish species are considered unlikely to be present in the areas within or immediately adjacent to the project boundary at the time of the works. Furthermore, the area of the Severn Estuary SAC that lies within the project boundary is less than 1% of the total SAC area, representing an insignificant proportion of the overall suitable habitat. Furthermore, there is likely to be sufficient alternative habitat for relocation of any qualifying fish species that are present away from the temporary construction works.

Therefore, based on the likely absence of Annex II fish species from the immediate vicinity of the works, the small scale of the works and availability of habitat elsewhere within the SAC, additional mitigation is not required as disturbance from the works will not lead to an adverse effect on the integrity of the SAC.

6.1.3.5 Mortality/Injury of Individuals

As described in Section 6.1.3.1, during construction pollutants could arise from machinery and/or faulty infrastructure.

There is a risk that the localised reduction in water quality within the Severn Estuary could impact Annex II fish species through direct mortality or injury (e.g. through ingestion), or displacement from the area around the site. Such potential impacts are considered to be of minor significance due to the relatively short construction period, the small zone of impact due to dispersal effects, and the subsequent improvement to water quality following construction. However, given the potential for a pollution event on site, mitigation measures are proposed in subsequent sections.

6.1.4 Mitigation Measures

6.1.4.1 Water Pollution

The risk of leakage or spillage of fuel, chemicals and other potentially polluting substances would be mitigated through good site practice and management, implemented via the final construction MS (Appendix E) for the site (which has been prepared by the contractor). The MS includes measures such as those contained within the Environment Agency's Pollution Prevention Guidelines 6 (PPG6¹⁸). All measures detailed in the agreed MS will be adhered to by contractors working on site. All construction activities will be carried out in accordance with guidance outlined within CIRIA best practice guidance.

The MS contains the following best practice methods to mitigate the risk of pollution (further detailed within Appendix E):

- The storage and use of hazardous chemicals would be in accordance COSHH Regulations (1998);
- Environmentally friendly products will be used where possible;
- All waste materials will be disposed of in designated skips/areas;
- Emergency spill kits are to be maintained at every work location or be easily accessible at all times from a centralised location;
- Equipment to be stored on designated drip trays/bundied areas;
- All refuelling operations are to be undertaken at the site compound, at least 20m from Splott beach;
- Refuelling operations must always be manned, never left alone, or the fuel trigger jammed open;

¹⁸ Working at construction and demolition sites: PPG6, Pollution Prevention Guidelines, Environment Agency, Accessed at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/290139/pmho0412bwfe-e-e.pdf

- Hoses and valves to be checked regularly for signs of wear and renew as and when required; and
- If a spill should occur, the following should be used: stop, contain and notify.

6.1.4.2 Spread of INNS

To ensure that INNS are managed appropriately and to control the spread of such species where present during the construction phase, the following measures will be taken:

- All site members to be made aware of the possible presence of INNS. If site members suspect that they may be present, they should immediately inform the supervisor and no attempt should be made to remove or disturb any suspected INNS;
- Pre-construction survey of all areas within construction footprint to identify the location of any invasive species (including marine algae and fauna);
- An Invasive Species Management Plan for preventing the spread of any invasive species should be produced and included within the final MS, if INNS are identified. Implementation of these requirements should be undertaken through site set up and provision of Toolbox Talks for all personnel prior to works commencing; and
- Guidance on the control of INNS¹⁹, would be followed if any INNS identified during the pre-construction survey are likely to be affected by the construction.

6.1.4.3 Mortality/Injury of Individuals

The mitigation outlined in Section 6.1.4.1 is also applicable for measures to mitigate impacts of injury/mortality to Annex II fish species within Severn Estuary SAC.

6.1.5 Residual Effects

With the inclusion of the mitigation measures outlined above it is concluded that the proposed development is unlikely to give rise to a significant adverse effect on the integrity of the Severn Estuary SAC.

¹⁹ Natural England, Department for Environment, Food & Rural Affairs (Defra) and Environment Agency (2014) How to identify, control and dispose of plants that can harm livestock and the environment.

6.2 Severn Estuary Ramsar site

6.2.1 Conservation Objectives

The features of this site are potentially vulnerable to the effects of water pollution, spread of INNS, physical disturbance of habitats, disturbance/displacement to faunal species, and mortality/injury of individuals.

Conservation objectives for this Ramsar site are taken from the conservation advice for the Severn Estuary EMS and are summarised as:

Criterion 1

The conservation objective for criterion 1 is to maintain the habitat features in favourable condition, as defined by the conservation objective for the corresponding SAC Annex I habitats in Section 6.1.1.1.

Criterion 3

The conservation objective for this criterion is to maintain the ‘estuaries’ feature in favourable condition, as defined by the conservation objective for the SAC ‘estuaries’ features in Section 6.1.1.1.

Criterion 4 and Criterion 8

The conservation objective for these criteria is to maintain the Annex II bird and fish features in favourable condition. The features will be considered to be in favourable condition when each of the following conditions are met:

- The migratory passage of both adults and juveniles of the assemblage of migratory fish species through the Severn Estuary between the Bristol Channel and any of their spawning rivers is not obstructed or impeded by physical barriers, changes in flows, or poor water quality;
- The size of the populations of the assemblage species in the Severn Estuary and the rivers which drain into it, is at least maintained and is at a level that is sustainable in the long term;
- The abundance of prey species forming the principle food resources for the assemblage species within the Estuary, is maintained; and
- Toxic contaminants in the water column and sediment are below levels which would pose a risk to the ecological objectives described above.

Criterion 5

The conservation objective for this criterion is to maintain the waterfowl assemblage feature in a favourable condition, as defined by the conservation objective for the corresponding SPA feature:

- The 5-year peak mean population size for the waterfowl assemblage is no less than 68,026 individuals (i.e. the 5-year peak mean between 1988/9 - 1992/3);
- The extent of saltmarsh and their associated strandlines is maintained;
- The extent of intertidal mudflats and sandflats is maintained;

- The extent of hard substrate habitats is maintained;
- Extent of vegetation of <10cm throughout the saltmarsh is maintained;
- The abundance and macroscale distribution of suitable invertebrates in intertidal mudflats and sandflats is maintained;
- The abundance and macroscale distribution of suitable invertebrates in hard substrate habitats is maintained;
- Greater than 25% cover of suitable soft leaved herbs and grasses during the winter on saltmarsh areas is maintained;
- Unrestricted bird sightlines of >500m at feeding and roosting sites are maintained; and
- Waterfowl aggregations at feeding or roosting sites are not subject to significant disturbance.

Criterion 6

The conservation objective for this criterion is to maintain the Annex II bird features in a favourable condition, as defined by the conservation objective for the corresponding SPA feature:

Gadwall

- The 5-year peak mean population size for the wintering gadwall population is no less than 330 (i.e. the 5-year peak mean between 1988/9 - 1992/3);
- The extent of intertidal mudflats and sandflats is maintained;
- Unrestricted bird sightlines of >200m at feeding and roosting sites are maintained; and
- Aggregations of gadwall at feeding or roosting sites are not subject to significant disturbance.

Greater white-fronted goose

- The 5-year peak mean population size for the wintering European white fronted goose population is no less than 3,002 individuals (i.e. the 5-year peak mean between 1988/9-1992/3);
- The extent of saltmarsh at the Dumbles is maintained;
- The extent of intertidal mudflats and sandflats at Frampton Sands, Waveridge Sands and the Noose is maintained;
- Greater than 25% cover of suitable soft-leaved herbs and grasses is maintained during the winter on saltmarsh areas;
- Unrestricted bird sightlines of >200m at feeding and roosting sites are maintained; and
- Aggregations of European white-fronted goose at feeding or roosting sites are not subject to significant disturbance.

Dunlin

- The 5-year peak mean population size for the wintering dunlin population is no less than 41,683 individuals (i.e. the 5-year peak mean between 1988/9 - 1992/3);
- The extent of saltmarsh and associated strandlines is maintained;

- The extent of intertidal mudflats and sandflats is maintained;
- The extent of hard substrate habitats is maintained;
- The extent of vegetation with a sward height of <10cm is maintained throughout the saltmarsh;
- The abundance and macro-distribution of suitable invertebrates in intertidal mudflats and sandflats is maintained;
- The abundance and macro-distribution of suitable invertebrates in hard substrate habitats is maintained;
- Unrestricted bird sightlines of >200m at feeding and roosting sites are maintained; and
- Aggregations of dunlin at feeding or roosting sites are not subject to significant disturbance.

Bewick's swan

- The 5-year peak mean population size for the Bewick's swan population is no less than 289 individuals (i.e. the 5-year peak mean between 1988/9 - 1992/3);
- The extent of saltmarsh at the Dumbles is maintained;
- The extent of intertidal mudflats and sandflats at Frampton Sands, Waveridge Sands and the Noose is maintained;
- The extent of vegetation with an effective field size of >6 ha and with unrestricted bird sightlines > 500m at feeding, roosting and refuge sites are maintained;
- Greater than 25% cover of suitable soft leaved herbs and grasses in winter season throughout the transitional saltmarsh at the Dumbles is maintained; and
- Aggregations of Bewick's swan at feeding, roosting and refuge sites are not subject to significant disturbance.

Common shelduck

- The 5-year peak mean population size for the wintering shelduck population is no less than 2,892 individuals (i.e. the 5-year peak mean between 1988/9 - 1992/3);
- The extent of saltmarsh is maintained;
- The extent of intertidal mudflats and sandflats is maintained;
- The extent of hard substrate habitats is maintained;
- The abundance and macro-distribution of suitable invertebrates in intertidal mudflats and sandflats is maintained;
- Unrestricted bird sightlines of >200m at feeding and roosting sites are maintained; and
- Aggregations of shelduck at feeding or roosting sites are not subject to significant disturbance.

Common redshank

- The 5-year peak mean population size for the wintering redshank population is no less than 2,013 individuals (i.e. the 5-year peak mean between 1988/9 - 1992/3);

- The extent of saltmarsh and associated strandlines is maintained;
- The extent of intertidal mudflats and sandflats is maintained;
- The extent of hard substrate habitats is maintained;
- The extent of vegetation with a sward height of <10cm throughout the saltmarsh is maintained;
- The abundance and macro-distribution of suitable invertebrates in intertidal mudflats and sandflats is maintained;
- The abundance and macro-distribution of suitable invertebrates in hard substrate habitats is maintained;
- Unrestricted bird sightlines of >200m at feeding and roosting sites are maintained; and
- Aggregations of redshank at feeding or roosting sites are not subject to significant disturbance.

6.2.2 Potential Effects

6.2.2.1 Water Pollution

As described above in Section 6.1.3.1, in the absence of any avoidance and/or mitigation measures, there is the potential for construction activities to result in a pollution incident. Annex I habitats that lie within the project boundary that may be subject to these negative effects include estuaries and mudflats and sandflats. There is also the potential to negatively impact the habitats on which the qualifying bird and fish species for Severn Estuary Ramsar site rely.

These negative effects are considered to be of minor significance, as described above. However, given the potential for a pollution event on site, mitigation measures are proposed in subsequent sections.

6.2.2.2 Spread of INNS

As described above in Section 6.1.3.2, there is the potential for INNS to be spread from within the project boundary elsewhere via construction worker's machinery and/or footwear.

If these INNS are allowed to spread and proliferate within the European Sites, it is considered that this could give rise to a significant negative effect on the Annex I habitats that lie within the project boundary (estuaries and mudflats and sandflats). There is also the potential to negatively impact the habitats on which the qualifying bird and fish species for Severn Estuary Ramsar site rely.

6.2.2.3 Physical Disturbance of Habitats

As described above in Section 6.1.3.3, it is considered that physical habitat disturbance due to the works will not lead to an adverse effect on Annex I habitats that lie within the project boundary (estuaries, and intertidal mudflats and sandflats) or on the habitats upon which Annex II fish species rely. Potential impacts to habitats upon which Annex II bird species rely are considered in more detail below.

The majority of Annex II bird species within the Ramsar site are designated as a qualifying feature only over the winter period (October to March (inclusive)). As such, they will not be impacted by physical habitat disturbance from the works, as the works are due to commence in May 2020 and last for approximately six weeks. However, some species are designated on passage in spring/autumn, including dunlin, redshank, ringed plover, and whimbrel. These species therefore may be present (albeit, at low densities) and susceptible to disturbance.

The area of the Ramsar site that lies within the project boundary is 0.01ha, which equates to just 0.00004% of the overall area of the Ramsar site. Therefore, there is likely to be sufficient alternative habitat for relocation of qualifying bird species away from the temporary construction works. Furthermore, it should be noted that there is a public coastal footpath ending on Splott beach which is public land, thus resulting in an existing level of potential disturbance, and large flocks of waders are therefore unlikely to be regularly present. As such, based on the scale of the works, existing disturbance in this location and availability of habitat elsewhere within the Ramsar site, additional mitigation (such as a dedicated ornithological watching brief during construction) is not required as disturbance from the works will not lead to an adverse effect on the integrity of the Ramsar site.

6.2.2.4 Disturbance/Displacement to Faunal Species

As described above in Section 6.1.3.4, it is considered that disturbance arising from construction noise and vibration will not lead to an adverse effect on Annex II fish species for which the Ramsar site is designated.

Potential impacts to Annex II bird species are likely to be minor as no piling or percussive works are anticipated on site, and no artificial lighting is proposed at any time. As described within Section 6.2.2.3 the Annex II bird species that are protected over the winter period will not be impacted by disturbance from the works, which are due to commence in May 2020, but on passage dunlin, redshank, ringed plover, and whimbrel may be present and susceptible to disturbance. However, it is considered that there is sufficient alternative habitat for relocation of qualifying bird species away from the temporary construction works. Furthermore, large flocks of waders are unlikely to be regularly present due to the public footpath ending on Splott beach.

Therefore, additional mitigation is not required as disturbance from the works will not lead to an adverse effect on the integrity of the Ramsar site.

6.2.2.5 Mortality/Injury of Individuals

As described in Section 6.1.3.1, during construction pollutants could arise from machinery and/or faulty infrastructure.

There is a risk that the localised reduction in water quality within the Severn Estuary could impact the Annex II bird and fish species through direct mortality or injury (e.g. through ingestion or by affecting plumage), or displacement from the area around the site. Such potential impacts are considered to be of minor significance due to the relatively short construction period, the small zone of impact due to dispersal effects, and the subsequent improvement to water quality

following construction. However, given the potential for a pollution event on site, mitigation measures are proposed in subsequent sections.

6.2.3 Mitigation Measures

6.2.3.1 Water Pollution

The mitigation outlined in Section 6.1.4.1 is also applicable for measures to mitigate impacts to the qualifying habitats and species within the Severn Estuary Ramsar site.

6.2.3.2 Spread of INNS

The mitigation outlined in Section 6.1.4.2 is also applicable for measures to mitigate impacts to the qualifying habitats and species within the Severn Estuary Ramsar site.

6.2.3.3 Mortality/Injury of Individuals

The mitigation outlined in Section 6.1.4.1 is also applicable for measures to mitigate impacts to the qualifying bird and fish species within the Severn Estuary Ramsar site.

6.2.4 Residual Effects

With the inclusion of the mitigation measures outlined above it is concluded that the proposed development is unlikely to give rise to a significant adverse effect on the integrity of the Severn Estuary Ramsar site.

6.3 In-Combination Assessment

The documents available on the Cardiff planning portal website were consulted when determining the potential impacts of the other plans or projects. An in-combination assessment was screened out for both Planning Applications A/19/00075/MNR and 19/02642/MJR. This is due to the nature of the works proposed in the planning applications and because no ecological or environmental report was available for these developments. Furthermore, neither of these applications are located within a European Site.

7 Proposals for Monitoring

7.1 Pre-Construction Monitoring

If more than two years have elapsed since the surveys were undertaken to inform this assessment further monitoring will be undertaken to provide up to date information on the presence of European Site features and other protected species.

As described in Section 6.1.3.2 above, a pre-construction survey for INNS should be undertaken in spring, prior to commencement of the works.

7.2 Monitoring During Construction

The contractor instructed to complete these works is to incorporate all recommended mitigation from this HRA into the MS.

7.3 Post-Construction Monitoring

With the inclusion of the mitigation measures outlined and the conclusion that there will not be an adverse effect on the integrity of the assessed European Sites, post-construction monitoring is not required.

If any unforeseen significant impacts arise during construction, contrary to the conclusions of this report, post-construction monitoring should be undertaken, in agreement with the relevant statutory environmental bodies.

8 Conclusion

The project comprises improvement works to Cardiff Central SPS, adjacent to Splott beach. Several European Sites exist within proximity to the project: Severn Estuary SAC, SPA, and Ramsar site, and Cardiff Beech Woods SAC. A number of qualifying Annex I habitats and Annex II bird and fish species have the potential to be impacted by the project.

A potential pathway for effect exists for habitat degradation in the form of pollution, the spread of INNS, and physical habitat disturbance, and for species disturbance in the form of visual, noise, and vibration effects, as well as species mortality/injury.

There is not predicted to be an operational effect on any European Site as all discharges will remain as existing or reduce, thus improving the water quality

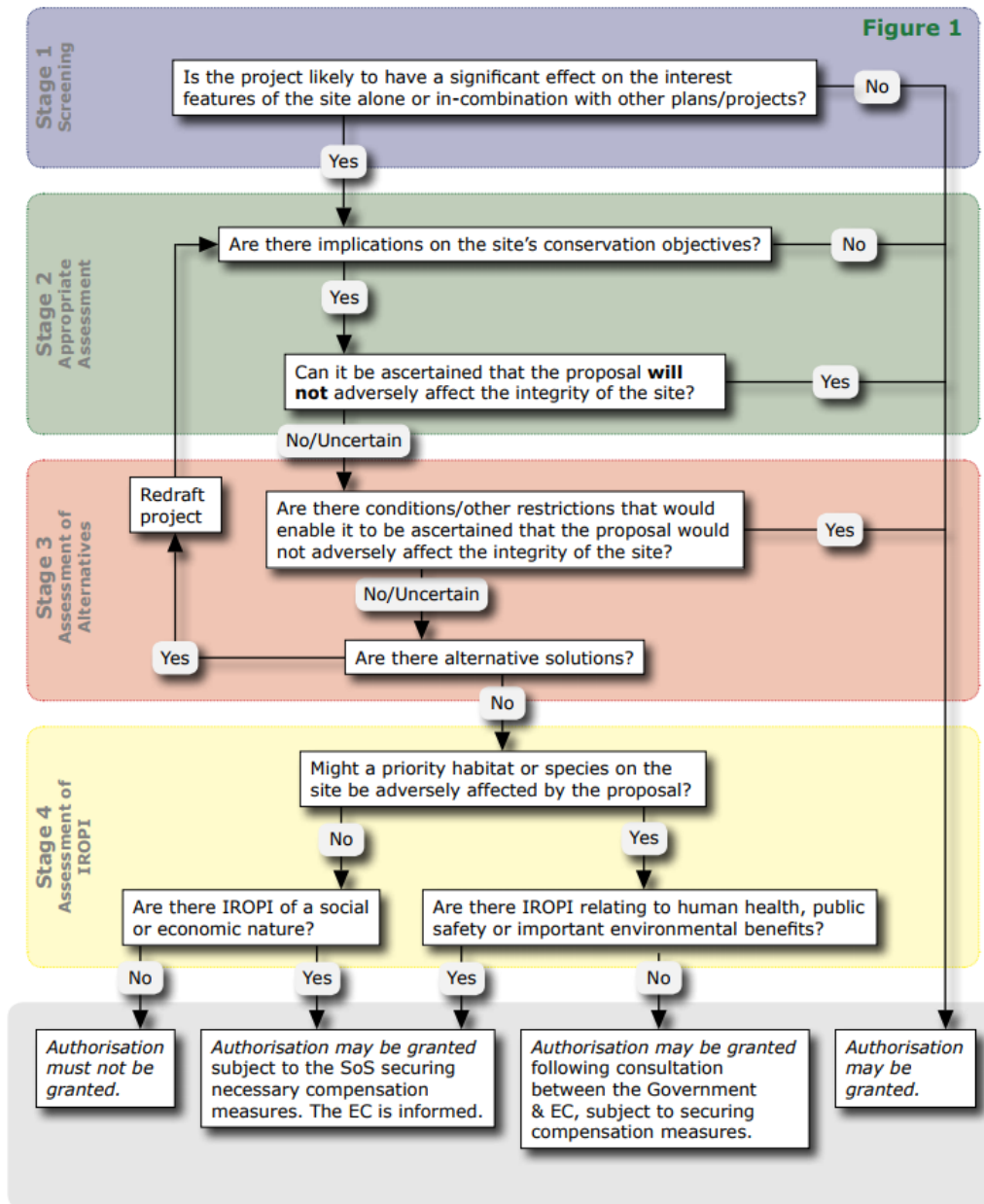
The Appropriate Assessment has considered these effects in relation to the Conservation Objectives for the features of the European Sites and identified suitable mitigation measures.

These measures along with the proposed monitoring are considered sufficient to ensure that the construction of the proposed development do not, either alone or in-combination with other plans or projects, give rise to any adverse effects on the integrity of the European Sites.

Appendix A

Habitats Regulations Assessment Process

A1 Habitats Regulations Assessment Process



Copied from: The Planning Inspectorate, 2013. Habitat Regulations Assessment for nationally significant infrastructure projects. Version 4, January.

Appendix B

Figures

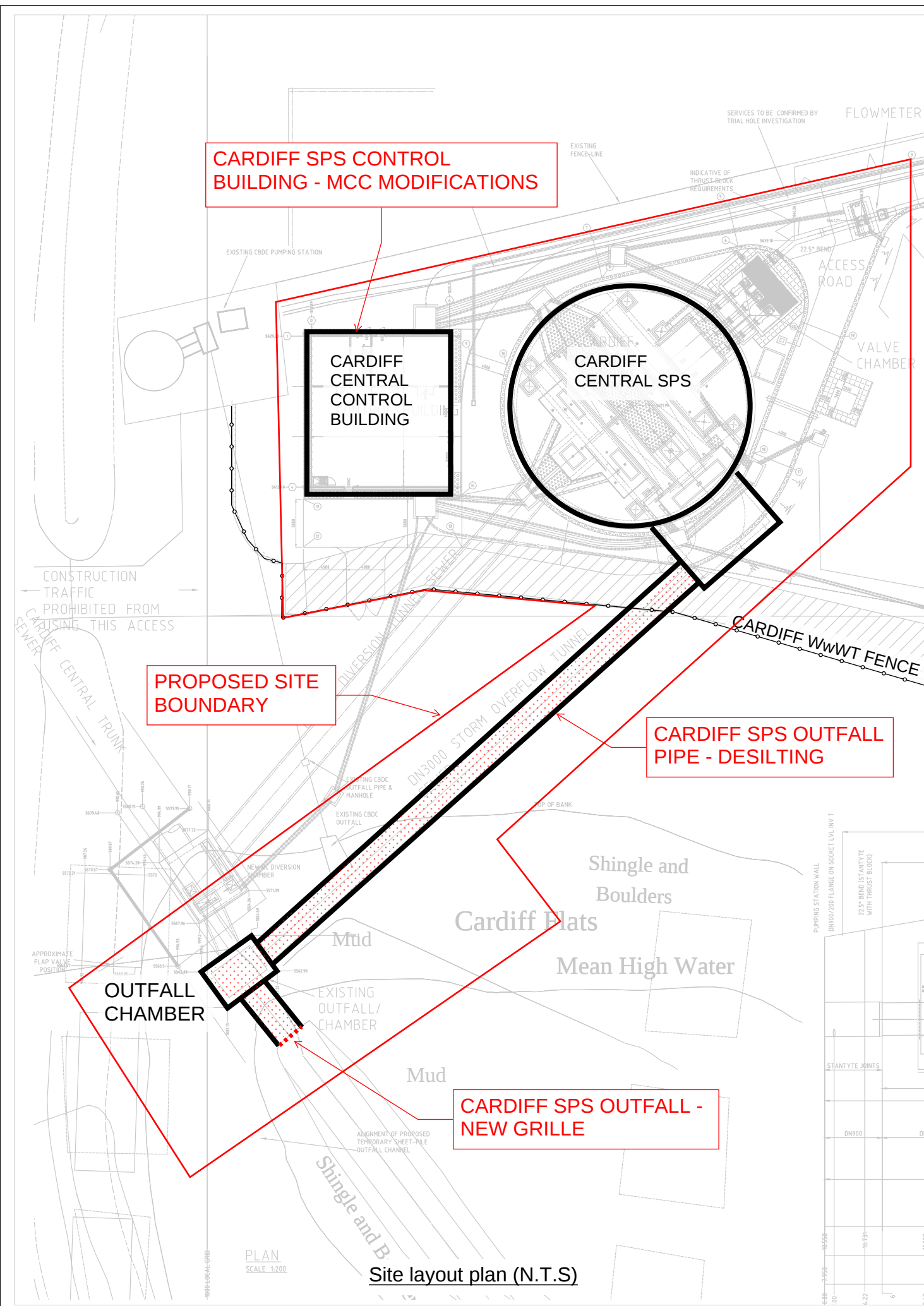
B1 Project Drawings

Figure 1: Works overview

B2 Ecological Figures

Figure 2: Extended Phase 1 Habitat Plan

Figure 3: European Sites within 10km of the Project



Existing outfall headwall Photo



Proposed outfall grille

Dwr Cymru Cyl has no duty to identify private apparatus and the information as to the position of the private apparatus is given by way of general guidance only on the strict understanding that it is based on the best information available and no warranty as to its correctness is relied upon in the event of excavations or other works made in the vicinity of the company's apparatus and any onus of locating the apparatus before carrying out any excavations rests entirely on you. It must be understood that the furnishing of the information is entirely without prejudice to the provision of the New Roads and Streetworks Act 1991 and of the Company's right to be compensated for any damage to its apparatus.

Dwr Cymru Cyl has no duty to identify private apparatus and the information as to the position of the private apparatus is given by way of general guidance only on the strict understanding that it is based on the best information available and no warranty as to its correctness is relied upon. Not all private apparatus is identified but their presence should be anticipated.

NOTES:

1. DRAWING BASED ON CARDIFF CENTRAL SITE LAYOUT AND RISING MAIN DETAILS SHEET 1 OF 2. DRAWING REFERENCE NE00928 ISSUE F

— EXISTING
— PROPOSED

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING:

CONSTRUCTION

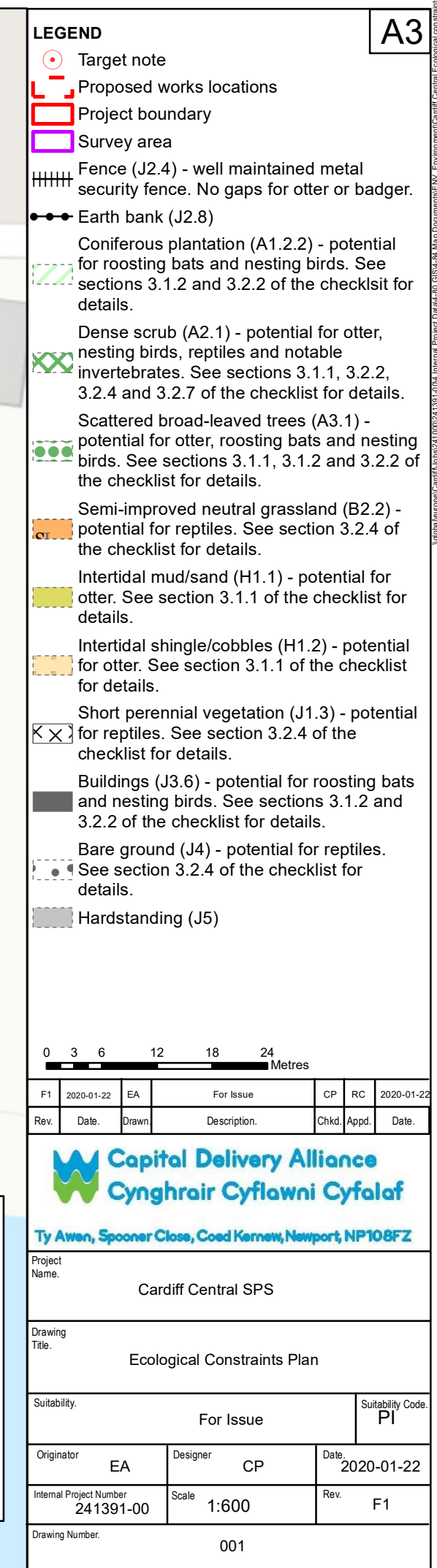


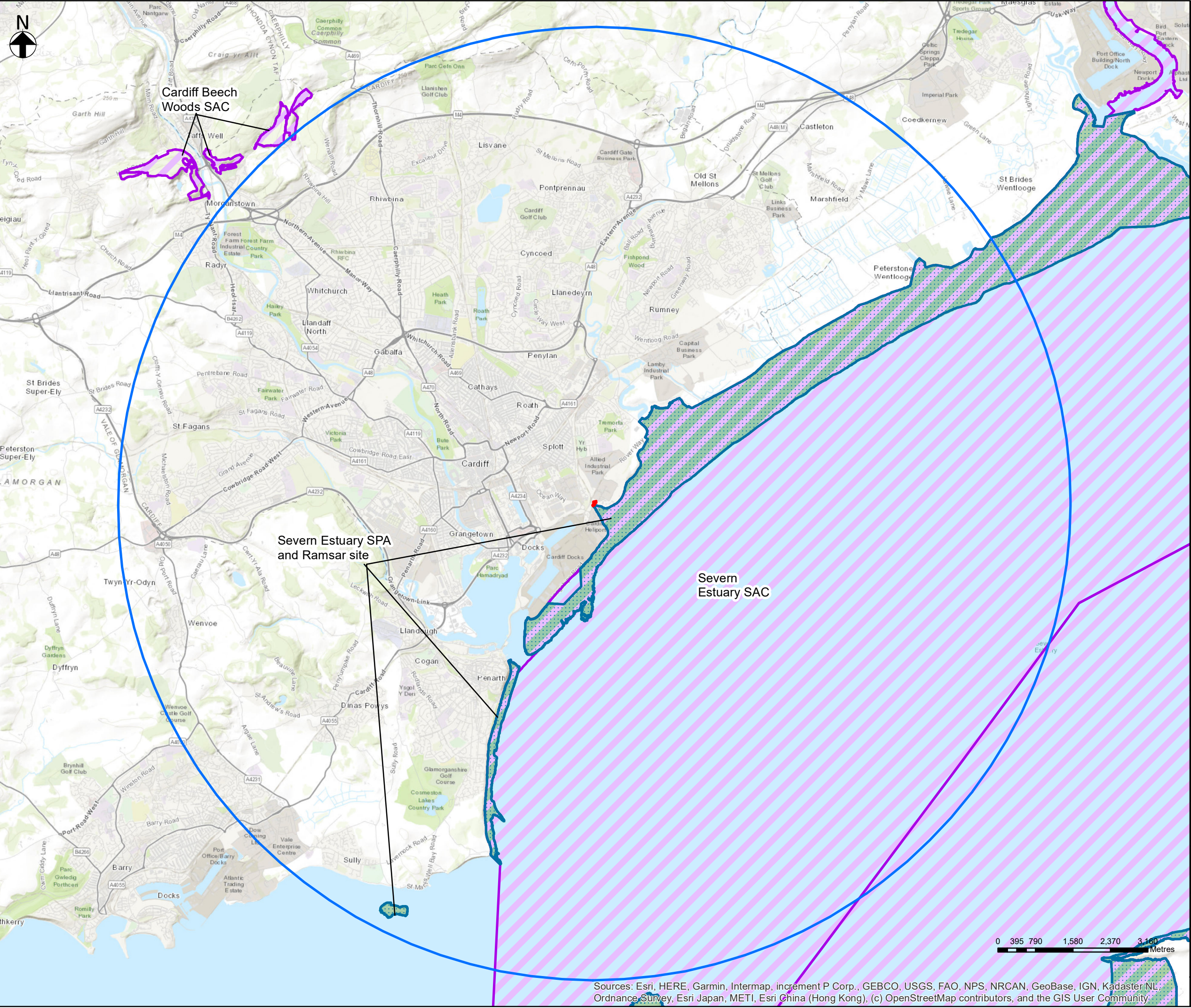
MAINTENANCE / CLEANING / OPERATION

DECOMMISSIONING / DEMOLITION

REFER TO THE DESIGN RISK REGISTER FOR FURTHER DETAILS. IT IS ASSUMED THAT ALL THE WORKS ON THIS DRAWING WILL BE CARRIED OUT BY A COMPETENT CONTRACTOR WHO HAS CARRIED OUT A COMPREHENSIVE RISK ASSESSMENT.

Rev.	Date	Drawn	Description	Chkd	Appd	Date
 Capital Delivery Alliance Cynghrair Cyflawni Cyfalaf						
Ty Awen, Spooner Close, Coed Kynwag, Newport, NP10 8FZ						
Project Name:		CARDIFF CENTRAL SEWAGE PUMPING STATION				
Drawing Title:		SCOPE OF WORKS (STAGE 3 AND STAGE 4)				
Suitability:					Suitability Code:	
FOR INFORMATION						
Originator:	AG		Designer:	AG		Date: 22.11.19
Internal Project Number:		Scale:		Rev:		
241391		NTS		P01		
Drawing Number:						
4293_S_205-ARP-XX-XX-DR-XX-06050						





A3

LEGEND

Project boundary

10km buffer

Special Protection Areas (SPA)

Special Areas of Conservation (SAC)

Ramsar sites

F1	2020-01-22	EA	For Issue	CP	RC	2020-01-22
Rev.	Date.	Drawn.	Description.	Chkd.	Appd.	Date.

Capital Delivery Alliance

Cynghrair Cyflawni Cyfalaf

Ty Awen, Spooner Close, Coed Kernew, Newport, NP108FZ

Project Name.

Cardiff Central SPS

Drawing Title.

European Sites within 10km of the Project

Suitability.	For Issue	Suitability Code.
		PI

Originator	EA	Designer	CP	Date.	2020-01-22
Internal Project Number	241391	Scale	1:75,000	Rev.	F1

Drawing Number.

001

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community.

0 395 790 1,580 2,370 3,160 Metres

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Appendix C

European Site Information Sheets

C1 European Site Information Sheets

The Severn Estuary / Môr Hafren European Marine Site

comprising :

**The Severn Estuary / Môr Hafren
Special Area of Conservation (SAC)**

**The Severn Estuary
Special Protection Area (SPA)**

**The Severn Estuary / Môr Hafren
Ramsar Site**

**Natural England & the
Countryside Council for Wales' advice
given under Regulation 33(2)(a) of the Conservation
(Natural Habitats, &c.) Regulations 1994, as amended.**

June 2009



A Welsh version of all or part of this document can be made available on request
from the Countryside Council for Wales

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SUMMARY

This document contains Natural England and the Countryside Council for Wales' (CCW's) advice issued under Regulation 33 of the Conservation (Natural Habitats, &c.) Regulations 1994, for the *Severn Estuary European Marine Site (EMS)*, which comprises the *Special Area of Conservation (SAC)*, *Special Protection Area (SPA)*, and *Ramsar site*, namely conservation objectives and advice on operations. It also includes an explanation of the purpose and format of Natural England and CCW's "Regulation 33 advice".

Section 1 provides the legal basis and practical requirements for setting conservation objectives for Natura 2000 sites, as understood by Natural England and CCW. It also briefly explains the legal and practical basis of the operations advice.

Section 2 details the qualifying features for the Severn Estuary SAC, SPA and Ramsar site under the EU Habitats and Birds directives and the Convention on Wetlands of International Importance.

Section 3 provides a description of the features of the Severn Estuary EMS

Section 4 contains Natural England and CCW's advice as to the conservation objectives (Regulation 33(2)(a)) for SAC, SPA and Ramsar site. This section also includes the favourable condition tables for the SAC, SPA and Ramsar site.

Section 5 contains Natural England and CCW's advice on operations which may cause deterioration or disturbance of the habitats and species for which the SAC, SPA and Ramsar site has been selected (Regulation 33(2)(b)). This is provided to assist the relevant authorities and others in understanding the implications of the designation of these sites and the requirements of the Habitats Regulations and government policy.

Section 6 contains the references.

Section 7 contains a glossary of terms.

Appendices 1-9 provide maps of the extent of the SAC, SPA and Ramsar designations; the indicative extent of the habitat features, and sub features where information is available; and the low-tide distribution of birds.

Appendices 10-11 provide additional background information useful to the understanding of this advice.

Notes :

CCW and Natural England's predecessor English Nature, issued advice under Regulation 33(2)(a) and 33(2)(b) in relation to the SPA in February 2005 which is now superseded by this document.

This advice does not cover the terrestrial areas of the Severn Estuary SPA (ie ground which lies behind flood defences and which are not subject to the tidal influence of the estuary and are not therefore within the European Marine Site.

CCW and Natural England also issued advice under Regulation 33(2)(a) in relation to the cSAC in June 2008 which is also superseded by this document.

1. Introduction

This document provides advice under Regulation 33 (2) for the Severn Estuary European Marine Site (EMS), which comprises the following sites :

- Severn Estuary Special Area of Conservation (SAC)*
- Severn Estuary Special Protection Area (SPA)
- Severn Estuary Ramsar Site

(*At the time of issue of this document the Severn Estuary has been accepted by the European Commission as a Site of Community Importance (SCI) but formal notices have not yet been issued (expected to take place in 2009). Given the imminent notification of the SAC the Severn Estuary SCI is referred to as SAC throughout this document).

The indicative extent and relationship of these designated sites is shown in Appendix 1

This document:

- is designed to help relevant and competent authorities responsible for complying with the requirements of the Habitats Directive to understand the international importance of the site and the underlying physical and ecological processes supporting the habitats and species for which each of the above designated sites has been selected.
- is intended to assist the relevant authorities to develop, if considered appropriate, a management scheme under Regulation 34 of the Habitats Regulations, under which they shall exercise their functions in accordance with the requirements of the Directive;
- contains Natural England and CCW's advice to competent authorities as to the conservation objectives of each of the above designated sites, for the purpose of considering plans and projects in accordance with Article 6 of the Habitats Directive and Parts IV and IVa of the Habitats Regulations. Natural England and CCW will provide more detailed advice to competent authorities to assess the implications of particular plans or projects, where appropriate, at the time those plans or projects are being considered.

Anyone proposing to undertake plans or projects with a potential impact on site features are encouraged to consult Natural England or CCW early in the planning stages to identify possible issues of concern.

The advice in this document is subject to review by Natural England and CCW, for example to:

- add further advice on monitoring requirements in order to assess the degree to which the conservation objectives are being achieved in future;
- add further advice on operations likely to damage the features for which the SPA, SAC and Ramsar Site are selected (under Habitats Regulation 33(2)(b));
- take account of new information about the SPA, SAC and Ramsar site or its features, or any future changes to the designations.

Notes :

CCW and Natural England's predecessor English Nature, issued advice under Regulation 33(2)(a) and 33(2)(b) in relation to the SPA in February 2005 which is now superseded by this document.

This advice does not cover the terrestrial areas of the Severn Estuary SPA (ie ground which lies behind flood defences are which are not subject to the tidal influence of the estuary and are not therefore within the European Marine Site.

CCW and Natural England also issued advice under Regulation 33(2)(a) in relation to the cSAC in June 2008 which is also superseded by this document.

1.1 Natura 2000

The European Union Habitats¹ and Birds² Directives are international obligations which set out a number of actions to be taken for nature conservation. They represent one of the ways in which EU member states are fulfilling the commitments they made at the “Earth Summit” in Rio de Janeiro in 1992, for the conservation of the Earth’s biological diversity³. The Habitats Directive aims to promote the maintenance of biodiversity, taking account of economic, social, cultural and regional requirements, and sets out measures to maintain or restore, natural habitats and species of European Union interest at favourable conservation status⁴.

European sites include Special Areas of Conservation (SACs) designated under the 1992 Habitats Directive, which support natural habitats and species of European importance, and Special Protection Areas (SPAs) classified under the 1979 Birds Directive, which support internationally important wild bird populations. UK and Welsh Assembly Government policy also requires that Ramsar sites should receive the same level of protection as European sites⁵.

The Habitats Directive is given effect in the UK largely through the Conservation (Natural Habitats, &c.) Regulations 1994 (“the Habitats Regulations”)⁶. These Regulations set out the powers and duties of UK statutory bodies towards compliance with the requirements of the Habitats Directive. Under these Regulations, SACs together with Special Protection Areas (SPAs) classified under the 1979 EC Birds Directive for the conservation of birds, are called “European sites” and will form a network of conservation areas to be known as ‘Natura 2000’. Where SAC or SPA consist of marine areas they are referred to as European Marine Sites.⁷

There are various sources of guidance on the legal framework for European sites and European Marine Sites.⁸

A note on Ramsar :

The Convention on Wetlands of International Importance especially as Waterfowl Habitats (Ramsar Convention) was signed in Ramsar, Iran in 1971. The broad objectives of the Convention are to stem the loss and progressive encroachment on wetlands now and in the future, including through the designation of Ramsar sites.

A habitat can qualify as a Ramsar site for its representation of a wetland, or for the plant or animal species, including waterbirds, that it supports.

In accordance with Office of the Deputy Prime Minister (2005) *Planning Policy Statement 9: Biological and Geological Conservation*, Welsh Office Planning Guidance *Technical Advice Note No. 5* (TAN5), the DETR and NAW statements *Ramsar Sites in England* (November 2000) and *Ramsar Sites in Wales* (February

¹ Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora.

² Council Directive 79/409/EEC on the conservation of wild birds.

³ Biological diversity is defined as “the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.” (1992 International Convention on Biological Diversity, Article 2. <http://www.biodiv.org/convention/>)

⁴ A habitat or species is defined as being at favourable conservation status when its natural range and the areas it covers within that range are stable or increasing and the specific structure and functions which are necessary for its long term maintenance exist and are likely to continue to exist for the foreseeable future.

⁵ Office of the Deputy Prime Minister (2005) *Planning Policy Statement 9: Biological and Geological Conservation*, Welsh Assembly Government (2006) *Draft Revised Technical Advice Note 5 Nature Conservation and Planning*, DETR (2000) *Ramsar sites in England*, National Assembly for Wales (20010, *Ramsar sites in Wales*.

⁶ SI 1994/2716, HMSO, London. http://www.legislation.hmsso.gov.uk/si/si1994/uksi_19942716_en_1.htm

⁷ “Marine areas” are defined in the Habitats Regulations as areas “continuously or intermittently covered by tidal waters or any part of the sea in or adjacent to Great Britain up to the limit of territorial waters.”

⁸ *European Marine Sites in England & Wales: A guide to the Conservation (Natural Habitats &c.) Regulations 1994 and to the Preparation and Application of Management Schemes* (DETR & The Welsh Office, 1998), Office of the Deputy Prime Minister (2005) *Planning Policy Statement 9: Biological and Geological Conservation*, Welsh Assembly Government (2006) *Draft Revised Technical Advice Note 5 Nature Conservation and planning*, CCW (undated) *Natura 2000: European wildlife sites*.

2001); Ramsar sites classified under the Convention on Wetlands of International Importance should be given the same consideration as European sites when considering plans and projects that may affect them.

1.2 The role of Natural England and the Countryside Council for Wales

Regulation 33 of the Habitats Regulations requires Natural England and the Countryside Council for Wales (CCW) to advise the relevant authorities⁹ for each European Marine Site in, or partly in, England and Wales as to

- (a) the conservation objectives for that site, and
- (b) any operations which may cause deterioration of natural habitats or the habitats of species, or disturbance of species, for which the site has been designated.

This document contains Natural England and CCW's advice under Regulation 33 in relation to the designated sites which comprise the Severn Estuary EMS.

The Conservation (Natural Habitats &c.) Regulations 1994, as amended transpose the Habitats Directive into law in Great Britain. They give Natural England and CCW a statutory responsibility to advise relevant authorities as to the conservation objectives for European Marine Sites and Ramsar Sites in England and Wales and to any operations which may cause deterioration of natural habitats or the habitats of species, or disturbance of species for which the sites have been designated. This information will be a key component of any management scheme that may be developed for this site. It will also aid competent authorities in defining the scope and nature of 'appropriate assessment' which the Habitats Directive requires to be undertaken for 'plans and projects' having a significant effect on the European site (Habitats Regulations 20, 48, 50, 60-62 and 85B). Note that Natural England and CCW will also advise competent authorities on individual plans and projects as they arise. Natural England and CCW are also competent and relevant authorities under the Habitats Regulations.

1.3 The precautionary principle

The advice on operations contained within this package has been made based on the precautionary principle and any actions which may need to be taken in response to concerns identified as a result of monitoring undertaken by Natural England and the Countryside Council for Wales will also be made on this basis. All forms of environmental risk should be tested against the precautionary principle which means that where there are real risks to the site, lack of full scientific certainty should not be used as a reason for postponing measures that are likely to be cost effective in preventing such damage. It does not however imply that the suggested cause of such damage must be eradicated unless proved to be harmless and it cannot be used as a licence to invent hypothetical consequences. Moreover, it is important, when considering whether the information available is sufficient, to take account of the associated balance of likely costs, including environmental costs, and benefits (DETR & the Welsh Office, 1998).

1.4 The role of other competent and relevant authorities

The Conservation (Natural Habitats &c.) Regulations 1994 require competent authorities to exercise their functions so as to secure compliance with the requirements of the Habitats and Birds Directives. The term "competent authority" includes all public bodies and statutory undertakers. The Regulations identify a number of competent authorities as "relevant authorities", with particular functions in relation to European Marine Sites. In addition to their duties as competent authorities, under Regulation 34 the relevant authorities may establish a management scheme for a European Marine Site under which they shall exercise their relevant functions. Such a management scheme should be guided by the information contained in this document. Relevant authorities must, within their areas of jurisdiction, have regard to both direct and indirect effects on an interest feature of the site. This may include consideration of issues outside the boundary of the European Marine Site.

⁹ The types of bodies that are "relevant authorities" are identified in Regulation 5 of the Habitats Regulations.

Relevant authorities should ensure that all plans for the area integrate with the management scheme for the European Marine Site. Such plans may include Shoreline Management Plans, the Environment Agency's Flood Risk Management Strategy and Catchment Flood Management Plans, Local Development Plans/Frameworks, Sites of Special Scientific Interest management plans, local Biodiversity Action Plans and sustainable development strategies for estuaries. This must occur to ensure that there is only a single management scheme through which all relevant authorities exercise their duties under the Conservation (Natural Habitats &c.) Regulations 1994.

Relevant authorities also need to have regard to changing circumstances of the European Marine Site and may therefore need to modify the management scheme and/or the way in which they exercise their functions so as to maintain the favourable condition of interest features concerned in the long term. There is no requirement for relevant authorities to take any actions outside their statutory functions. For the purposes of this document the term 'interest feature' refers to any of the habitat types or species for which the European Marine Sites have been designated.

Under certain circumstances, where another relevant authority is unable to act for legal reasons, or where there is no other relevant authority, Natural England and CCW are empowered to use their bylaw-making powers under Regulation 36 of the Habitats Regulations 1994.

None of the information contained in this document legally binds any organisation (including Natural England and CCW) to any particular course of action. However, in exercising their functions in accordance with the requirements of the Habitats Directive, as required by the Habitats Regulations, and in accordance with government policy on Ramsar sites, the relevant authorities should be guided by the advice contained in this document. This applies amongst other things to the establishment of a "management scheme"¹⁰, if such a scheme is established.

1.5 Responsibilities under other conservation designations

In addition to its SAC, SPA and Ramsar Site status, parts of the Severn Estuary are also notified as Sites of Special Scientific Interest (SSSIs) under the 1981 Wildlife and Countryside Act and Bridgwater Bay is also a National Nature Reserve. The obligations of relevant authorities and other organisations under such designations are not directly affected by the advice contained in this document.

Relevant authorities and others may have obligations towards the conservation of habitats and species that are not features for which the Severn Estuary European Marine Site has been designated, and such obligations are not affected by this document.

1.6 Role of advice provided under Regulation 33

The information provided under Regulation 33 is in two parts: the conservation objectives, and the advice on operations. The legal context for each of these elements, the format of the advice and its underlying rationale are explained here. Sections 4 (conservation objectives and favourable condition tables) and 5 (operations advice) should be read in conjunction with these explanatory notes.

The information contained in this document is based on best available knowledge at time of writing and is subject to review at Natural England and CCW's discretion.

As referred to under section 1.1. above, there are various sources of guidance on the legal framework for European sites and European Marine Sites.¹¹

¹⁰ Regulation 34 of the Habitats Regulations.

¹¹ European Marine Sites in England & Wales: A guide to the Conservation (Natural Habitats &c.) Regulations 1994 and to the Preparation and Application of Management Schemes (DETR & The Welsh Office, 1998), Office of the Deputy Prime Minister (2005) Planning Policy Statement 9: Biological and Geological Conservation, Welsh Assembly Government (2006) Draft Revised Technical Advice Note 5 Nature Conservation and planning, CCW (undated) Natura 2000: European wildlife sites.

1.6.1 Outline of legal context and purpose of conservation objectives

The conservation objectives for a European Marine Site are intended to represent the aims of the Habitats and Birds Directives in relation to that site. The Habitats Directive requires that measures taken under it, including the designation and management of SACs, be designed to maintain or restore habitats and species of European Community importance at “favourable conservation status” (FCS), as defined in Article 1 of the Directive as follows;

Favourable conservation status as defined in Article 1 of the Habitats Directive

Conservation status of a natural habitat means the sum of the influences acting on a natural habitat and its typical species that may affect its long-term natural distribution, structure and functions as well as the long-term survival of its typical species within the territory referred to in Article 2.

The conservative [sic] status of a natural habitat will be taken as ‘favourable’ when:

- its natural range and the areas it covers within that range are stable or increasing, and
- the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and
- conservation status of typical species is favourable as defined in [Article] 1(i).

Conservation status of a species means the sum of the influences acting on the species concerned that may affect the long-term natural distribution and abundance of its populations within the territory referred to in Article 2;

The conservation status of a species will be taken as ‘favourable’ when:

- population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and
- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and
- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis

In addition, the Birds Directive requires that, in relation to certain species of birds listed in Annex 1 of the Directive and regularly occurring migratory species, special measures are taken in order to ensure their survival and reproduction in their area of distribution. The species listed in Annex 1 of the Birds Directive are the subject of special conservation measures concerning their habitat in order to ensure their survival and reproduction in their area of distribution. Species listed on Annex 1 are in danger of extinction, rare or vulnerable. Annex 1 species that regularly occur at levels over 1% of the national population meet the SPA qualifying criteria.

Therefore, the conservation objectives for the Severn Estuary SAC, SPA and Ramsar site represents Natural England and the Countryside Council for Wales' current judgement of the appropriate contribution of the site to the achievement of the favourable conservation status of the habitats and species of the European Marine Site. The conservation objectives in this document are intended to guide relevant and competent authorities in the exercise of their functions to comply with the requirements of the Directives outlined above.

1.7 Condition

Natural England and CCW use the term “favourable condition” for the condition represented by the achievement of the conservation objectives, in other words the desired condition for a designated habitat or a species on an individual site.

On many terrestrial European sites, we know sufficient about the required condition of qualifying habitats to be able to define favourable condition with confidence. In contrast understanding the functioning of large, varied, dynamic marine and estuarine sites, which experience a variety of pressures resulting from historic and current activities, is much more difficult. Consequently it is much harder to precisely define favourable condition in sites like the Severn Estuary. In general the conservation objectives provided are based on a working assumption that the current condition of the features is favourable for most attributes. Nevertheless there are certain instances where the assumption does not apply. In particular some of the intertidal habitats of the Severn are subject to coastal squeeze. Where existing problems *have* been identified, the relevant objectives reflect this.

If it becomes evident that the condition of other features is significantly degraded, and is therefore unfavourable, then restorative management actions will need to be undertaken to return the interest feature to favourable condition. In future revisions of our advice under Regulation 33, Natural England and CCW will keep our assumption under review in light of ongoing and future monitoring and our developing understanding of the features and the factors affecting them.

1.8 Favourable Condition Tables

The detailed information regarding the measures and targets that may be used during site monitoring to determine whether favourable condition is being achieved in practice is presented within the Favourable Condition Tables in section 4.

The favourable condition table specifies the following (in columns from left to right):

- **Features:** interest features for which the SAC, SPA or Ramsar site is selected.
- **Subfeatures:** ecologically important sub-divisions of an interest feature. In the case of a habitat interest feature, subfeatures would be component habitats or communities (eg. defined by type and/or by geographic location within the site). In the case of species interest features, subfeatures include the population itself, or any ecologically relevant subdivisions of the population, and any habitats or communities on which it/they depend.
- **Attributes:** particular characteristics of the features or sub-features which provide an indication of the condition of the feature (eg. total population size, extent of a habitat type).
- **Measures:** what exactly about the attributes will be measured, in terms of the units of measurement to be used, arithmetic nature and an indication of the frequency at which the measurement is taken. An indication of the method that is likely to be used to obtain the observed values of attributes. The method is closely linked to the way in which the measure is expressed. It is important to note that in many cases the precise monitoring method to be used may not be known at this stage.
- **Targets:** These define the attribute values that equate to favourable condition. If changes are observed that are ‘significantly’ different from the target, this will act as a trigger for further investigation as to the cause of the change, or remedial management action. In general the targets in the favourable condition table are subject to natural processes as set out in the conservation objectives; i.e. where natural processes alone dictate that targets are not met this will not result in the condition of the feature being classed as unfavourable. The term ‘subject to natural processes’ is explained further in Section 4.1.
- **Comments:** notes on the rationale for the use of each attribute and measure.

The favourable condition table is intended to supplement the conservation objectives, including with respect to the management of established and ongoing activities, future requirements of monitoring and reporting on the condition of the features of the site and, together with the conservation objectives, informs the scope and

nature of any appropriate assessment that may be needed. The table **does not by itself** provide a comprehensive basis on which to assess plans and projects as required under the Habitats Regulations. It should be noted that appropriate assessments are a separate activity to condition monitoring, requiring consideration of issues specific to individual plans or projects. Natural England and CCW will provide more detailed advice to competent and relevant authorities to assess the implications of any given plan or project under the Regulations, where appropriate, at the time a plan or project is being considered.

The favourable condition table specifies the main types of information that Natural England and CCW may use to assess the condition of interest features. On many terrestrial European sites, we know sufficient about the preferred or target condition of qualifying species and habitats to be able to define measures and associated targets for all attributes. In European Marine Sites favourable condition is generally harder to define precisely since our knowledge of features is still developing. Accordingly, in the absence of such information, condition of interest features in European Marine Sites will, in the first instance, be assessed against targets based on their condition at the time the sites were selected, which may need to be established through baseline surveys in many cases.

The information contained within the favourable condition table is not necessarily what will be monitored but provides a basis for discussions with management and advisory groups. The attributes and associated measures and targets may be modified over time. The selection of attributes is based on the current understanding of the habitats and species and the available measuring techniques.

The appropriateness of individual attributes as indicators of condition will be reviewed as more knowledge of the condition of interest features is obtained and/or survey and monitoring techniques develop. Monitoring of the attributes may be of fairly coarse methodology, underpinned by more rigorous methods on specific areas within the site.

The favourable condition table will be an important, but not the only, driver of the site monitoring programme. Other data, such as results from compliance monitoring and appropriate assessments, will also have an important role in assessing condition of interest features. The monitoring programme will be developed as part of the management scheme process through discussion with the relevant authorities and other interested parties. Natural England and the Countryside Council for Wales will be responsible for collating the information required to assess condition, some of which may be collected by other organisations, and for judging the condition of each feature within the site, taking into account all available information and using the favourable condition table as a guide.

The conservation objectives and associated Favourable Condition Tables in this document are intended to guide relevant and competent authorities in the exercise of their functions to comply with the requirements of the Directives outlined above.

1.9 Advice on operations

1.9.1 Legal context

Natural England and CCW's specific duty in Regulation 33 to give advice on operations that are potentially damaging needs to be seen in the context of the Habitats Directive, which requires that:

- the necessary conservation measures are established which correspond to the ecological requirements of the habitats and species on the site;
- appropriate steps are taken to avoid deterioration of habitats and significant disturbance of species.
- any plan or project which is likely to have a significant effect on a site is subject to an appropriate assessment in view of the site's conservation objectives.

The operations advice, in combination with the conservation objectives, is designed to assist relevant authorities and other decision-makers in complying with these provisions. The operations advice given in this document is without prejudice to other advice given, including the conservation objectives themselves

and other advice which may be given by Natural England and CCW from time to time in relation to particular operations.

The term “operations” is taken to cover all types of human activity, irrespective of whether they are under any form of regulation or management.¹² This is because the obligations in the Directive are

defined by the conservation requirements of the habitats and species, not by existing regulatory or management regimes. Thus the advice contains reference to operations which may not be the responsibility of any of the relevant authorities.

1.9.2 Practical requirements

Operations manifest themselves through one or more factors¹³. The conservation status of a given habitat or species could potentially be affected by many different types of factor, and hence many different types of operation.¹⁴ The key practical purpose of the Regulation 33 operations advice is to assist in the identification of priorities for management, by identifying operations to which features are both ‘sensitive’ and ‘vulnerable’. Sensitivity is defined as ‘the intrinsic intolerance of a habitat, community or individual of a species to damage from an external factor.’ Vulnerability is defined as ‘the likelihood of exposure of a habitat, community or individual of a species to a factor to which it is sensitive’.¹⁵ Thus the potential for an operation to deteriorate or disturb a feature depends both on the sensitivity of the feature to the operation – through its associated factors - and the location, intensity, duration and frequency of the operation and the factors that it affects or causes.

Formulating the operations advice has three main elements:

1. Identifying factors to which the features are sensitive.
2. Identifying the types of operation that can cause or affect those factors.
3. Assessing the likelihood of those factors (and hence the features) being affected by those operations, in other words the vulnerability of the feature to those effects.

The first and second of these elements relies on current understanding of the inherent sensitivity of features to particular factors, and the effect of operations on factors. Although there will be site-specific elements to this information, it may often rely on information from a variety of sources which are not specific to this site. The third stage is very site-specific, relying on information about the types, location, intensity, duration and so on, of operations occurring or likely to occur in or around the site.

Given that in many cases, information of the type indicated in the previous paragraph is rudimentary, or simply not available a precautionary approach is adopted for the identification of factors and operations. The operations advice clearly has to be based on the best available knowledge at the time and is subject to continual review. It necessarily involves an element of risk assessment, both in terms of assessing the likelihood of an operation or factor occurring, and the likelihood of it having an adverse effect on a feature.

Natural England and CCW’s advice to the relevant authorities is that, as a minimum, the extent and management of the operations identified in Section 5 should be reviewed in the context of the conservation objectives. The advice should also help to identify the types of plans or projects that would be likely to have a significant effect and should be subject to appropriate assessment, noting that such judgements will need to be made on a case-specific basis.

¹² The term also includes what the Habitats Directive and Regulations call “plans and projects” (see footnote 9).

¹³ A factor is defined as “A component of the physical, chemical, ecological or human environment that may be influenced by a natural event or a human activity” (*Sensitivity and mapping of inshore marine biotopes in the southern Irish Sea (Sensmap): Final report*. CCW, Bangor, December 2000.)

¹⁴ The complexity of formulating operations advice is compounded by the “many-to-many” relationship that exists between operations and factors, where an operation may manifest itself through several factors, and a factor may be affected by several operations, in different ways and to different magnitudes.

¹⁵ Adapted from Hiscock, K. [ed] 1996. *Marine Nature Conservation Review: rationale and methods*. Peterborough: JNCC.

The advice in Section 5 of this document is not a list of prohibited operations, or operations necessarily requiring consultation with, or consent¹⁶ from, Natural England or CCW. The input of the relevant authorities and others is a legal and practical necessity in determining the management needs of the site. Thus, the operations advice is provided specifically with the intention of initiating dialogue between Natural England, CCW and the relevant authorities.

Note : The advice on operations previously issued for the SPA in February 2005 is superseded by the advice given in Section 5.

¹⁶ However, in relation to land included within the European Marine Site, which has been notified as a Site of Special Scientific Interest (SSSI), owners or occupiers require Natural England or CCW's consent for any operations included in the SSSI notification, and statutory bodies intending to carry out or permit potentially damaging operations must notify Natural England or CCW and comply with certain other provisions. (Wildlife and Countryside Act 1981, section 28, as amended by the Countryside and Rights of Way Act 2000, section 75). General guidance on the operation of SSSIs is given in the CCW leaflet *Sites of Special Scientific Interest: A guide for landowners and occupiers* (Countryside Council for Wales, Bangor, 2001).

2. Qualifying features under the EU Habitats and Birds Directives and the Convention on Wetlands of International Importance

Table 1 shows the wide range of nature conservation features for which the estuary is valued and the interrelationship of these features by designation. This table outlines features of European and International importance in their own right and others of national importance for which the Severn Estuary has been designated as a Site of Special Scientific Interest (SSSI) but which form an intrinsic part of the Severn ecosystem and therefore contribute to the overarching “estuary” feature of the SAC and Ramsar Site.

Table 1 : Summary of Notified features of each designation :

Feature	SAC	SPA	Ramsar Site	SSSI (Nationally important feature)
Estuary	Yes	<i>Supporting habitat to designated bird interests</i>	Yes	(Yes)
Subtidal sandbanks	Yes	No – outside boundary of SPA	No – outside boundary of Ramsar Site	<i>No – outside boundary of SSSI</i>
Intertidal Mud and Sand	Yes	<i>Supporting habitat to designated bird interests</i>	<i>Component of Ramsar “estuaries” feature and supporting habitat to designated bird interests</i>	Yes
Atlantic salt meadow / salt marshes	Yes	<i>Supporting habitat to designated bird interests</i>	<i>Component of Ramsar “estuaries” feature and supporting habitat to designated bird interests</i>	Yes
Reefs	Yes	No	<i>Intertidal Sabellaria contiguous with subtidal reefs is a component of the hard substrates subfeature of the Ramsar “estuaries” feature</i>	No – outside boundary of SSSI
Migratory fish (river & sea lamprey & twaite shad)	Yes	No	Yes	(Yes)
Migratory fish (salmon, eel, sea trout and Allis Shad)	<i>Part of notable species sub-feature of estuary feature</i>	No	Yes	(Yes)
Assemblage of fish species (>100 species)	<i>Notable species sub-feature of estuary feature</i>	No	<i>Notable species sub-feature of estuary feature</i>	(Yes)
Internationally important populations of migratory bird species	<i>Notable species sub-feature of estuary feature</i>	Yes	Yes	Yes
Internationally important populations of wintering bird species	<i>Notable species sub-feature of estuary feature</i>	Yes	Internationally important populations of waterfowl	Yes
Assemblage of nationally important populations of waterfowl	<i>Notable species sub-feature of estuary feature</i>	Yes	Yes	Yes
Hard substrate habitats (Rocky shores)	<i>Notable species sub-feature of estuary feature</i>	<i>Supporting habitat to designated bird interests</i>	<i>Component of Ramsar “estuaries” feature and supporting habitat to designated bird interests</i>	Yes
Freshwater grazing marsh / Neutral grassland	No	<i>Supporting habitat to designated bird interests within SPA but outside European Marine Site and therefore not addressed in this Regulation 33 advice document</i>		Yes (currently England only)

2.1 Qualifying interest features of the Severn Estuary / Môr Hafren SAC

The Severn Estuary has been designated an SAC on the basis that it supports occurrences of habitat types and species listed in Annexes I and II respectively of the Habitats Directive that are considered important in a European context and meeting the criteria in Annex III of the Directive. These are the interest features of the SAC and are listed in the Table 2 and their relationships are shown in Figure 1.

The designation includes an overarching “**estuaries**” feature within which **subtidal sandbanks, intertidal mudflats and sandflats, Atlantic salt meadows** and **reefs** (of *Sabellaria alveolata*) and **three species of migratory fish** are defined as both features in their own right and as sub-features of the estuary feature.

In addition **hard substrate habitats** including **eel grass beds**, the estuary-wide **assemblage of fish species** and the **assemblage of waterfowl species** (for which the Ramsar Site and SPA are specifically designated) are identified as **notable estuarine assemblages** which are an intrinsic part of the estuary ecosystem – these are therefore covered by the “estuaries” feature.

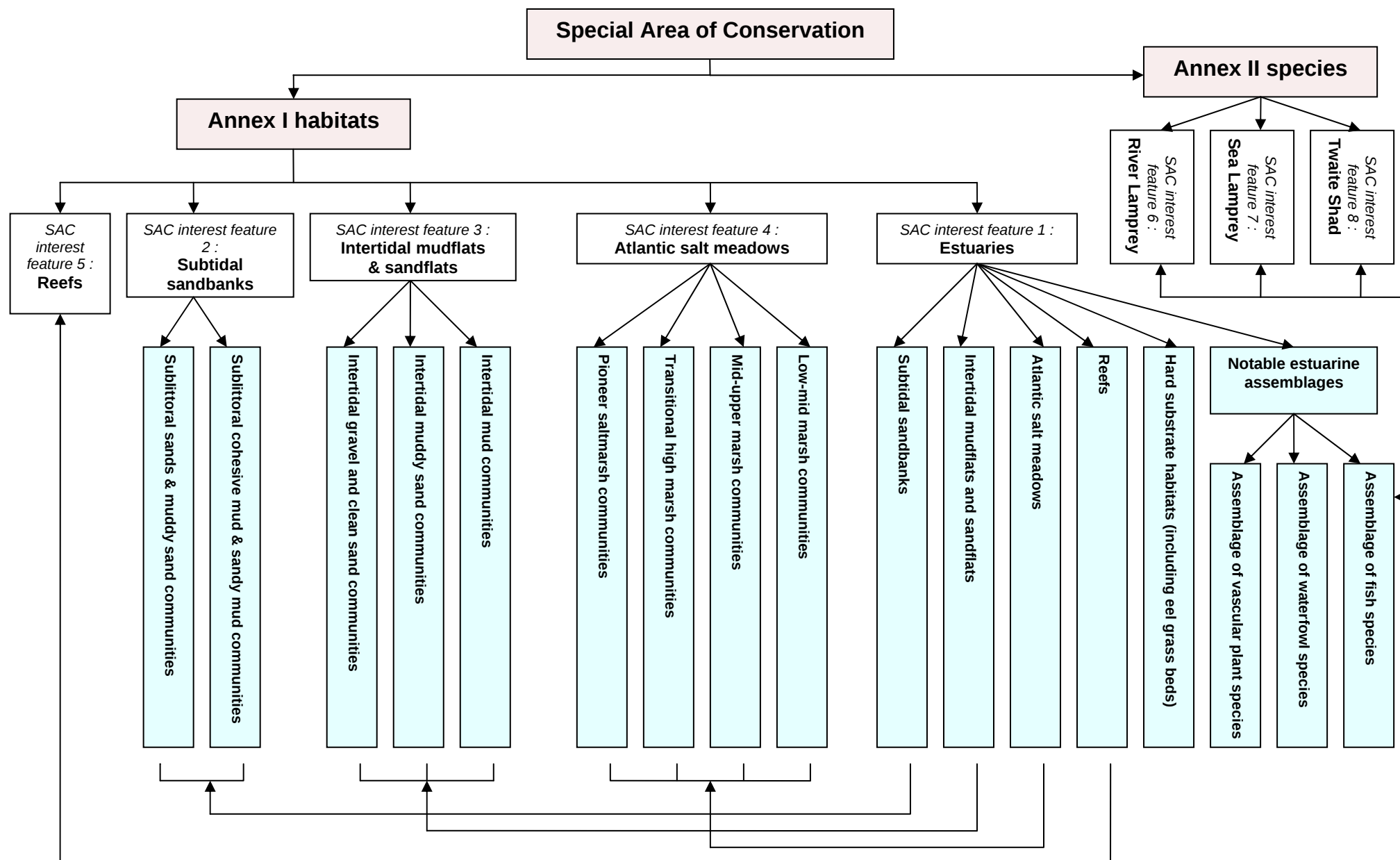
Table 2 : Interest features of the SAC

Feature name	Scientific term ¹⁰	EU Code ¹⁷
Annex I habitat types		
SAC interest feature 1: Estuaries	Estuaries	1130
SAC interest feature 2: Subtidal sandbanks	Sandbanks which are slightly covered by seawater all the time	1110
SAC interest feature 3: Intertidal mudflats and sandflats	Mudflats and sandflats not covered by seawater at low tide	1140
SAC interest feature 4: Atlantic salt meadows	Atlantic salt meadows (<i>Glauco puccinellietalia maritima</i>)	1330
SAC interest feature 5: Reefs	Reefs	1170
Annex II species		
SAC interest feature 6: River lamprey	<i>Lampetra fluviatilis</i>	1099
SAC interest feature 7: Sea lamprey	<i>Petromyzon marinus</i>	1095
SAC interest feature 8: Twaite shad	<i>Alosa fallax</i>	1103

Each interest feature has a conservation objective in Section 4 of this document.

¹⁷ European Commission (2007) Interpretation Manual of EU Habitats EUR27 July 2007, and Natura 200- Standard Data Form Explanatory Notes, Appendix C.

Figure 1 : Flow chart showing the relationship between the interest features of the Severn Estuary SAC (shown in white boxes) and their component sub features (shown in blue boxes). NB Some habitats that are sub features of the Annex II estuary feature are also features in their own right with their own sub features.



2.2 Qualifying interest features of the Severn Estuary / Môr Hafren SPA

The Severn Estuary was classified as an SPA on 13 July 1995 (subsuming a previously designated SPA called the Upper Severn Estuary) . The 1995 citation accompanying the classification is the baseline for the advice issued in this document. The qualifying interest features of the Severn Estuary SPA are shown in Table 3.

It should be noted that since designation changes in bird numbers have occurred in relation to the qualifying thresholds, which have themselves changed. These changes are highlighted by the SPA review published by the JNCC and details are also shown in Table 3. These changes are likely to be the subject of formal changes to the SPA designation in due course, however at present the legally protected species remain those in the original 1995 citation. (Note : Further information on the peak counts of the SPA species and waterfowl assemblage between 1988/9 and 2006/07 are given in Appendix 11.)

The SPA within the European Marine Site boundary includes saltmarshes and the adjacent extensive areas of intertidal mud, sand and rocky shores. All these habitats provide essential food and resting places for the wide range of wintering and migratory waterfowl and are therefore identified as key “supporting habitats” for the conservation of these species. The relationship between the features and supporting habitats supporting habitats is shown in Table 3. The supporting habitats are mapped in Appendix 8 to show their distribution and extent.

Notes relating to Table 3

*¹ Severn Estuary SPA original citation from July 1995 (though updated by Natural England in July 2002, version 2.3).

*² JNCC Severn Estuary SPA Review, dated 2001 available from the JNCC www.jncc.gov.uk/pdf/SPA/UK9015022.pdf (Stroud, DA, et al., 2001)

*³ JNCC Natura 2000 Standard Data Form, May 2006, version 1.1.

*⁴ 5 year peak mean, 1988/89 – 1992/93.

*⁵ 5 year peak mean, 1991/92 – 1995/96.

*⁶ 5 year peak mean, 01/04/1998.

Table 3 : The qualifying interest features and supporting habitats of the Severn Estuary SPA.

Species	Original SPA citation (1995) * ¹	SPA Review (2001) * ²	Natura 2000 form (2006) * ³	Notes	Supporting habitats
Internationally important populations of regularly occurring Annex 1 species [under Article 4.1 of the EU Birds Directive].					
SPA interest feature 1 : Bewick's swan <i>Cygnus columbianus bewickii</i>	✓	✓	✓	Over-wintering	Intertidal mudflats and sandflats Saltmarsh
Internationally important populations of regularly occurring migratory bird species [under Article 4.2 of the EU Birds Directive].					
SPA interest feature 2 : European white-fronted goose <i>Anser albifrons albifrons</i>	✓	x	✓	Over-wintering	Intertidal mudflats and sandflats Saltmarsh Hard substrate habitats (Freshwater coastal grazing marsh, improved grassland and open standing waters also occur within the SPA but these habitats lie outside EMS boundary)
SPA interest feature 3 : Dunlin <i>Calidris alpina alpina</i>	✓	✓	✓		
SPA interest feature 4 : Redshank <i>Tringa totanus</i>	✓	✓	✓		
SPA interest feature 5 : Shelduck <i>Tadorna tadorna</i>	✓	✓	✓		
SPA interest feature 6 : Gadwall <i>Anas strepera</i>	✓	x	✓		
Curlew <i>Numenius arquata</i>	x	✓	x		
Pintail <i>Anas acuta</i>	x	✓	x		
Ringed plover <i>Charadrius hiaticula</i>	x	✓	x	On passage	
SPA interest feature 7 : Internationally important assemblage of waterfowl (wildfowl & waders) [under Article 4.2 of the EU Birds Directive].					
Bewick's swan <i>Cygnus columbianus bewickii</i>	✓	✓	The Natura 2000 data form does not list separate waterfowl species within this assemblage.	The wintering waterfowl assemblage includes all regularly occurring waterfowl. Species that qualify as a listed component of the assemblage include all the internationally important regularly occurring migratory species as well as the Annex 1 wintering species. The list also includes species present in nationally important numbers or species whose populations exceed 2,000 individuals In the original citation, in winter, it is stated that the area regularly supported 68,026 individual waterbirds * ⁴ . In the SPA Review it is stated that the area regularly supports 93,986 individual waterfowl in winter * ⁵ . In the Natura 2000 form, in winter, it is stated that the area regularly supports 84,317 waterfowl * ⁶ .	Intertidal mudflats and sandflats Saltmarsh Hard substrate habitats (Freshwater coastal grazing marsh, improved grassland and open standing waters also occur within the SPA but these habitats lie outside EMS boundary)
European white-fronted goose <i>Anser albifrons albifrons</i>	✓	✓			
Dunlin <i>Calidris alpina alpina</i>	✓	✓			
Redshank <i>Tringa totanus</i>	✓	✓			
Shelduck <i>Tadorna tadorna</i>	✓	✓			
Gadwall <i>Anas strepera</i>	✓	✓			
Wigeon <i>Anas penelope</i>	✓	✓			
Teal <i>Anas crecca</i>	✓	✓			
Pintail <i>Anas acuta</i>	✓	✓			
Pochard <i>Aythya ferina</i>	✓	✓			
Tufted duck <i>Aythya fuligula</i>	✓	✓			
Ringed plover <i>Charadrius hiaticula</i>	✓	x			
Grey plover <i>Pluvialis squatarola</i>	✓	✓			
Curlew <i>Numenius arquata</i>	✓	✓			
Whimbrel <i>Numenius phaeopus</i>	✓	✓			

Species	Original SPA citation (1995) * ¹	SPA Review (2001) * ²	Natura 2000 form (2006) * ³	Notes	Supporting habitats
Spotted redshank <i>Tringa erythropus</i>	✓	x			
Lapwing <i>Vanellus vanellus</i>	x	✓			
Mallard <i>Anas platyrhynchos</i>	x	✓			
Shoveler <i>Anas clypeata</i>	x	✓			

Information on populations of bird species using the Severn Estuary European Marine Site at the time the SPA was classified is contained in Table 4 and their relationships are shown in Figure 2.

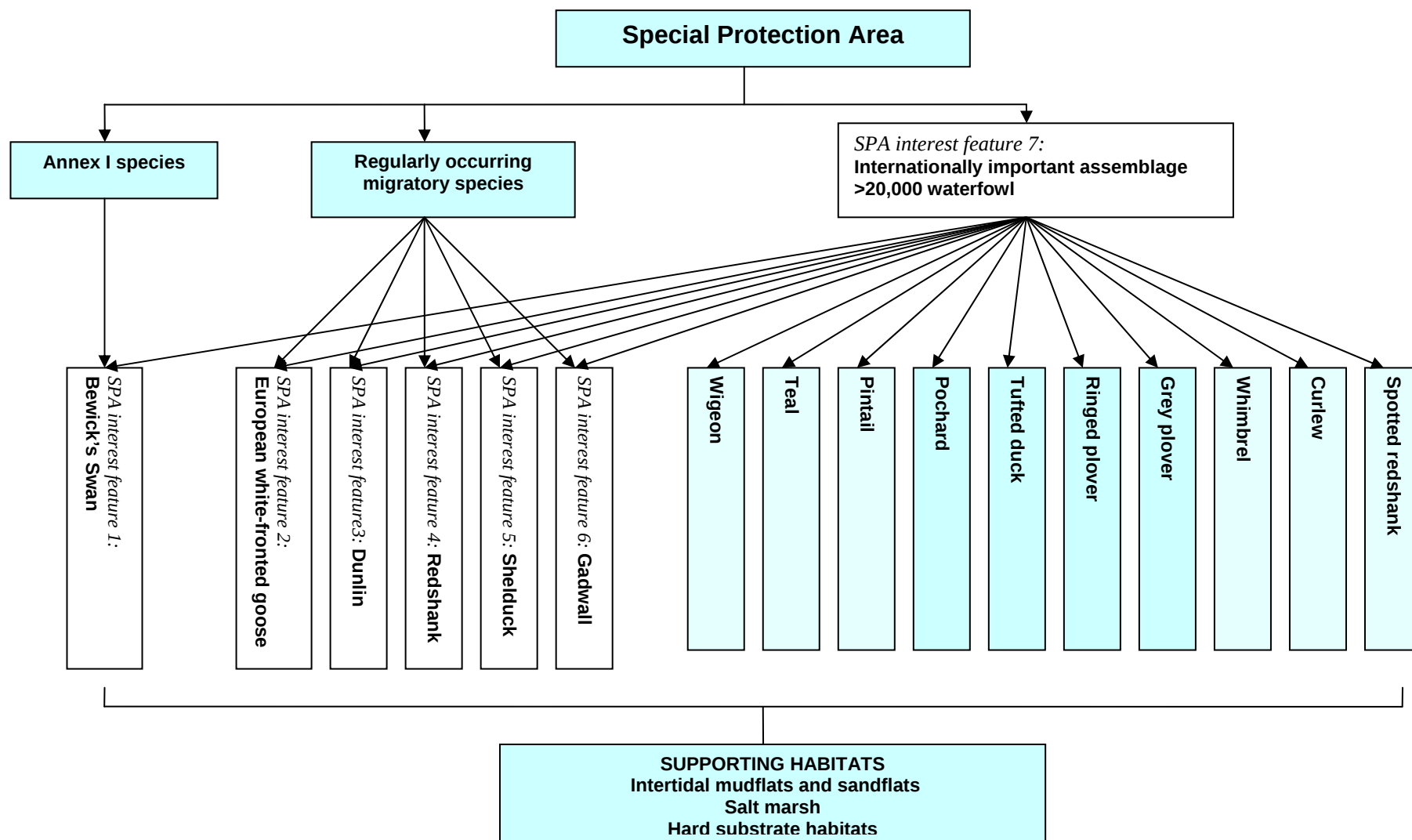
Table 4 : Information on populations of bird species using the Severn Estuary European Marine Site at the time the Severn Estuary SPA was classified (1995).

Internationally important populations of regularly occurring Annex 1 species		
Species	Population (5 yr peak mean :1988/9 to 1992/3)	
SPA interest feature 1: Bewick’s swan	289 birds	4.1% Great Britain 1.7% NW Europe
Internationally important populations of regularly occurring migratory bird species		
Species (wintering)	Population (5 yr peak mean: 1988/9 to 1992/3)	
SPA interest feature 2: European white-fronted goose	3,002	50% British, 1% North West Europe
SPA interest feature 3: Dunlin	41,683	2.9% East Atlantic flyway
SPA interest feature 4: Redshank	2,013	1.3% East Atlantic flyway
SPA interest feature 5: Shelduck	2,892	1.2% North West Europe
SPA interest feature 6: Gadwall	330	2.8 % NW Europe
SPA interest feature 7: An internationally important assemblage of waterfowl (Assemblage includes above species plus the following listed nationally important populations)		
Importance	Population (5 yr peak mean: 1988/9 to 1992/3)	
The Severn Estuary supports over 20,000 wintering waterfowl.	68,026 individual birds comprising 17,502 wildfowl and 50,524 waders	
Nationally important bird populations within internationally important assemblage of waterfowl		
Species	Population (5 yr peak mean: 1988/9 to 1992/3)	
Wigeon	3,977 birds	1.6% Great Britain
Teal	1,998	2.0% Great Britain
Pintail	523	2.1% Great Britain
Pochard	1,686	3.8% Great Britain
Tufted duck	913	1.5% Great Britain
Ringed plover	227	1.0% Great Britain
Grey plover	781	3.7% Great Britain
Curlew	3,096	3.4% Great Britain
Whimbrel	246	4.9% Great Britain
Spotted redshank	3	1.5% Great Britain
Notes : 1. Previous advice issued in respect of the Severn Estuary SPA in February 2005 excluded Gadwall for the listed species of internationally important populations of regularly occurring migratory birds as they were considered not to use the European Marine Site area to any significant degree. Further recent evidence (2002/03 Low Tide Bird Counts) has demonstrated that this species does make use of areas within the European Marine Site and has consequently now been included. 2. The SPA review has identified that since the classification of the Severn Estuary SPA in 1995 the Severn Estuary now supports nationally important populations of Mallard, Lapwing and Shoveler.		

(Note : Further information on the peak counts of the SPA species and waterfowl assemblage between 1988/9 and 2006/07 are given in Appendix 11.)

Each interest feature has a conservation objective in Section 4 of this document. Reference should also be made to sections of this document that relate to the Severn Estuary SAC interest features (particularly with respect to the conservation requirements of the supporting habitats) and the Severn Estuary Ramsar Site interest features.

Figure 2 : Flow chart showing the relationship between the qualifying bird species features (in white boxes) of the Severn Estuary SPA and their supporting habitats



2.3 Qualifying interest features of the Severn Estuary/ Môr Hafren Ramsar Site

The Severn Estuary was classified as a Ramsar Site on 13 July 1995 (subsuming a previously designated Upper Severn Estuary Ramsar Site). The 1995 citation is the basis for the advice issued in this document as this defines the legally protected species covered by the Ramsar designation at this time.

It should be noted that a number of changes have been made to the criteria since the listing of the Severn Estuary Ramsar Site and it is these new (2005) criteria which are now presented on the JNCC website used by many authorities as a reference source. For completeness qualification under both the criteria used at the time of 1995 Ramsar designation and the revised 2005 criteria have been outlined in Table 5 which provides a confirmation of the defined Ramsar features for which Conservation Objectives have been written.

The qualifying interest features of the Severn Estuary Ramsar Site overlap with those of the Severn Estuary SPA and SAC. To facilitate the development of integrated objectives across the designations the Ramsar criteria have been interpreted and the Ramsar features defined so that they are consistent with those already identified in the SAC and SPA sections of this document.

Table 5 : confirmation of Ramsar features in context of 1995 and 2005 Ramsar criteria

Ramsar Features (for which conservation objectives have been written)	Criteria at designation (1995) (original criteria)	Revised Criteria (2005) (criteria currently used on JNCC website)
Ramsar interest feature 1: *Estuaries <i>- characteristic physical form and flow, estuarine habitat communities and species assemblages</i> <i>- estuarine habitat communities and species assemblages</i>	Criterion 1 : qualifies due to its immense tidal range affecting both the physical environment and biological communities present	Criterion 1 : qualifies due to immense tidal range (second-largest in world), this affects both the physical environment and biological communities.
	Criterion 2b : qualifies due to its unusual estuarine communities, reduced species diversity and high productivity. The high tidal range leads to strong tidal streams and high turbidity, producing communities characteristic of the extreme physical conditions of liquid mud and tide swept sand and rock	Criterion 3 : qualifies due to its unusual estuarine communities, reduced diversity and high productivity
Ramsar interest feature 2: Assemblage of migratory fish species : Sea Lamprey River Lamprey Twaite Shad Allis Shad Salmon Sea Trout Eel	Criterion 2c : qualifies as it is important for the run of migratory fish between sea and river via estuary. Species include Salmon <i>Salmo salar</i> , sea trout <i>S. trutta</i> , sea lamprey <i>Petromyzon marinus</i> , river lamprey <i>Lampetra fluviatilis</i> , allis shad <i>Alosa alosa</i> , twaite shad <i>A. fallax</i> , and eel <i>Anguilla anguilla</i> .	Criterion 4 : qualifies as it is important for the run of migratory fish between sea and river via estuary. Species include Salmon <i>Salmo salar</i> , sea trout <i>S. trutta</i> , sea lamprey <i>Petromyzon marinus</i> , river lamprey <i>Lampetra fluviatilis</i> , allis shad <i>Alosa alosa</i> , twaite shad <i>A. fallax</i> , and eel <i>Anguilla anguilla</i> .
* The wider estuarine fish assemblage is covered as a “notable species assemblage” sub feature of the SAC “Estuaries” feature		Criterion 8 : qualifies as the fish assemblage of the whole estuarine and river system is one of the most diverse in Britain, with over 110 species recorded.

Table continued ...

Ramsar Features (for which conservation objectives have been written)	Criteria at designation (1995) (original criteria)	Revised Criteria (2005) (criteria currently used on JNCC website)
Ramsar interest feature 3: Bewick's Swan Ramsar interest feature 4: European white-fronted goose Ramsar interest feature 5: Dunlin Ramsar interest feature 6: Redshank Ramsar interest feature 7: Shelduck Ramsar interest feature 8: Gadwall ie Internationally important populations of waterfowl	Criterion 3c : qualifies by regularly in winter supporting internationally important populations (1% or more) of species of waterfowl Bewick's swan European white-fronted goose Dunlin Redshank Shelduck Gadwall	Criterion 6 : qualifies as it regularly supports 1% of the individuals in a population of one species or subspecies of waterbird. Species with peak counts in winter - at designation: Tundra/Bewick's swan Greater /European white-fronted goose Dunlin Common redshank Common shelduck Gadwall
Ramsar interest feature 9: Internationally important assemblage of waterfowl This feature incorporates : - waterfowl which contribute to the total peak winter count (criterion 3a) - the above internationally important wintering populations (qualifying under criterion 3c) - the migratory passage species (qualifying under criterion 2c) - the nationally important populations (identified under other notable features of the Ramsar Site citation) The species are as follows : (w = wintering and p = passage):	Qualifies under Criterion 2c as it is particularly important for migratory birds during passage periods in spring and autumn. Nationally important populations of : Ringed plover Dunlin Whimbrel Redshank	Populations identified subsequent to designation: Ringed plover (spring/autumn) Eurasian teal (winter) Northern pintail (winter) Lesser black-backed gull (breeding)
Bewick's swan (w) European white-fronted goose (w) Shelduck (w) Dunlin (w, p) Redshank (w, p) Gadwall (w) Ringed plover (w, p) Whimbrel (p) Teal (w) Pintail (w) Wigeon (w) Pochard (w) Tufted duck (w) Grey plover (w) Curlew (w) Spotted redshank (w)	Criterion 3a : qualifies by regularly supporting in winter over 20,000 waterfowl - (1988/89 to 1992/93 average peak count was 68,026 waterfowl: 17,502 wildfowl and 50,524 waders) Other notable features : Nationally important wintering populations of: Wigeon, teal, pintail, pochard, tufted duck, ringed plover, grey plover, curlew and spotted redshank. Also nationally important breeding population of Lesser Black backed gull	Criterion 5 : qualifies as it supports an assemblage of international importance - (1998/99-2002/2003 5 year peak mean was 70,919 waterfowl)

Each interest feature has a conservation objective in Section 4 of this document.

Reference should also be made to sections of this document that relate to the Severn Estuary SAC interest features (particularly with respect to the conservation requirements of the supporting habitats) and the Severn Estuary SPA interest features.

Information on the populations of bird species using the Severn Estuary Ramsar Site at the time of designation is contained in Table 6 and their relationships are shown in Figure 3. Ramsar interest feature 9 incorporates both wintering and passage populations of some birds and hence some species are included more than once in the lists given in Table 6.

Table 6 : Information on populations of bird species using the Severn Estuary Ramsar Site at the time of classification (1995)

<i>Ramsar interest features3 to 8:</i> Internationally important <u>populations</u> of wintering waterfowl (1995 Ramsar Criterion 3c)		
Species	Population (5 yr peak mean: 1988/9 to 1992/3)	
<i>Ramsar interest feature 3: Bewick’s swan</i>	289	4.1% Great Britain, 1.7% North West Europe
<i>Ramsar interest feature 4: European white-fronted goose</i>	3,002	50% British, 1% North West Europe
<i>Ramsar interest feature 5: Dunlin</i>	41,683	2.9% East Atlantic flyway, 9.6% British
<i>Ramsar interest feature 6: Redshank</i>	2,013	1.3% East Atlantic flyway, 2.6% British
<i>Ramsar interest feature 7: Shelduck</i>	2,892	1.2% NW European, 3.9 % British
<i>Ramsar interest feature 8: Gadwall</i>	330	2.8 % NW European, 5.5 % British
<i>Ramsar interest feature 9:</i> Internationally important <u>assemblage</u> of waterfowl (1995 Ramsar Criterion 2c, 3a and 3c) <i>(Assemblage includes above wintering species populations plus the following listed nationally important populations (migratory passage and wintering species))</i>		
International importance (1995 Ramsar Criterion 3a)	Population (5 yr peak mean: 1988/9 to 1992/3)	
Regularly supporting in winter over 20,000 waterfowl.	68,026 individual birds comprising 17,502 wildfowl and 50,524 waders	
Nationally important bird populations within internationally important assemblage of waterfowl (1995 Ramsar Criterion 2c and other nationally important populations)		
Species	Population (5 yr peak mean: 1987/8 to 1991/2)	
Dunlin	3,510 (spring migration) 5,500 (autumn migration)	1.7 % British passage 2.7 % British passage
Redshank	2,456 (autumn migration)	2 % British passage
Ringed plover	442 (spring migration) 1,573 (autumn migration)	1.4 % British passage 5.2 % British passage
Whimbrel	246 (spring migration) 66 (autumn migration)	4.9 % British passage 1.3 % British passage
	Population (5 yr peak mean: 1988/9 to 1992/3)	
Wigeon	3,977 birds	1.6% Great Britain
Teal	1,998	2.0% Great Britain
Pintail	523	2.1% Great Britain
Pochard	1,686	3.8% Great Britain
Tufted duck	913	1.5% Great Britain
Grey plover	781	3.7% Great Britain
Curlew	3,096	3.4% Great Britain
Spotted redshank	3	1.5% Great Britain

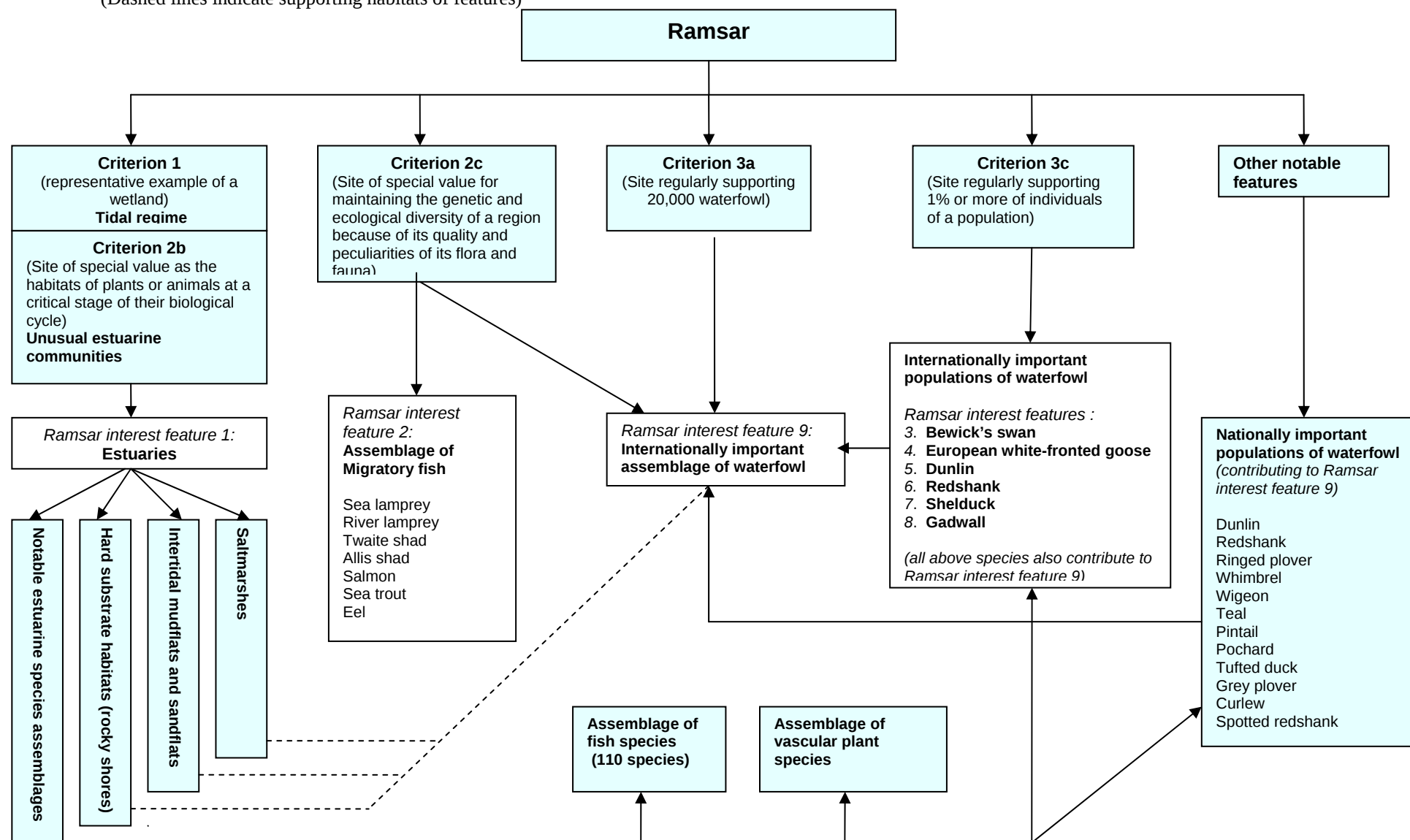
(Note : Further information on the peak counts of the SPA species and waterfowl assemblage between 1988/9 and 2006/07 are given in Appendix 11.)

The Ramsar Site within the European Marine Site boundary includes saltmarshes and the adjacent extensive areas of intertidal mud, sand and rocky shores. All these habitats provide essential food and resting places for the wide range of wintering and migratory waterfowl and are therefore identified as key “supporting habitats” for the conservation of these species. The relationship between the Ramsar Site bird features (Ramsar interest features 3 to 9) and their supporting habitats is shown in Table 7. The supporting habitats are mapped in Appendix 8 to show their distribution and extent.

Table 7 : A summary of the qualifying bird features and associated supporting habitats within the Severn Estuary Ramsar Site

Designation	Qualifying feature	Protected Supporting habitats		
		Estuary		
		Intertidal mudflats and sandflats	Hard substrate habitats (rocky shores)	Saltmarsh
Ramsar Site (classified 13 July 1995)	<i>Ramsar interest features 3 to 8 :</i> Internationally important populations of individual species of waterfowl	✓	✓	✓
	<i>Ramsar interest feature 9:</i> Internationally important assemblage of waterfowl	✓	✓	✓

Figure 3 : Flow chart showing the relationship between the interest features (in white boxes) for which the Severn Estuary Ramsar Site qualifies. (Dashed lines indicate supporting habitats of features)



3. General description of the Severn Estuary and its designated features

Introduction

The Severn Estuary is the largest example of a coastal plain estuary in the United Kingdom and one of the largest estuaries in Europe. The overall area of the European and International conservation designations is 73,715.4 ha (see Appendix 1) of which roughly two thirds is composed of subtidal habitats (stable sandbanks and shifting sediments of gravel, sand and mud) and one third is composed of intertidal habitats (tide washed mud and sand, saltmarshes and rocky shores).

The estuary lies in the broad Severn Vale, with most of the sediments on the margins of the estuary having accumulated since the last ice age. As with many other estuaries in England and Wales, it has been a focus for human activity, a location for settlement, a source of food, water and raw materials and a gateway for trading and exploration. The Estuary and its coastal hinterland support the cities of Cardiff, Bristol, Newport and Gloucester. Today, major industries are sited around the Estuary's shores. There are modern port installations, chemical processing companies and nuclear power stations among others. Exploitation of the natural resources includes commercial shrimp fishing and fishing for salmon using putchers, lave nets, draught nets and bag nets. The Severn supports an important eel and elver fishery. Aggregate extraction also occurs within the estuary.

Alongside all these competing activities, the Estuary also supports a wide array of habitats and species of international importance for nature conservation.

Human activity has increasingly influenced the character of the marginal wetland mudflats and marshes, with extensive land claim occurring during and since the Roman period. Sediment flows and fluxes affecting the estuary are of particular importance for estuarine processes and ecology and the morphology of the estuary is constantly changing due to the complex hydrodynamics. Sediment deposits provide essential material to maintain the mudflats, sandflats and saltmarsh. Estuary-wide fluctuations in the wind-wave climate over recent centuries have led to major movements of the high-tide shoreline, and some reclaimed lands have been lost (Allen, 1990, Atkins, W.S. 2004). In addition, the Severn Estuary CHaMP (ABPMer, 2006) predicts losses of intertidal mudflats and sandflats and saltmarsh habitats over the next 100 years in response to rising sea-level.

A number of habitats and species have also been recognised through the designation of several Sites of Special Scientific Interest (most notably, the Upper Severn Estuary, Severn Estuary and Bridgwater Bay SSSIs in the 1980's) which underpin the European and International designations.

The following sections briefly describe each of the main habitat and species features covered by the three designations and the inter-relationships between them. All feature descriptions are based on best available knowledge at the present time and in some cases this is limited. For example there is limited information on the extent of the subtidal reef habitat within the estuary. Maps showing the distribution of the habitats are indicative only and the advice in this document is provided on the basis of current knowledge and may be subject to change as knowledge improves.

3.1 Estuaries

3.1.1 Range

Estuaries are habitat complexes which comprise an interdependent mosaic of subtidal and intertidal habitats, which are closely associated with surrounding terrestrial habitats. Many of these habitats, such as mudflats and sandflats not covered by sea water at low tide, saltmarshes, sandbanks which are slightly covered by sea water all the time and reefs, are identified as Annex I habitat types in their own right.

Estuaries are defined as the downstream part of a river valley, subject to the tide and extending from the limit of brackish water. There is a gradient of salinity from freshwater in the river to increasingly marine conditions towards the open sea.

Estuaries are widespread throughout the Atlantic coasts of Europe. Approximately one-quarter of the area of estuaries in north-western Europe occurs in the UK. The UK has over 90 estuaries¹⁸.

The selection of estuary sites has taken account of the UK's EU responsibility for this habitat type, and the SAC series contains a high proportion of the total UK resource. Sites have been selected to represent the geographical range of estuaries in the UK, and to encompass examples of the four geomorphological sub-types (coastal plain, bar-built, complex, and ria estuaries) and the associated range of communities. Selection has generally favoured larger estuaries, as they display a wider variety of habitats, but smaller estuaries have also been selected where they have specific features of interest, such as undisturbed transitions from marine to terrestrial habitats, or are representative of a particular geomorphological sub-type.

The Severn Estuary is the largest example of a coastal plain estuary in the UK, and one of the largest estuaries in Europe. It contributes approximately 30% of the UK Natura 2000 resource for estuaries, by area.¹⁹

3.1.2 Extent and Distribution

The extent of the Estuary feature is 73678 ha.

The Severn Estuary SAC covers the extent of the tidal influence from an upstream limit between Frampton and Awre in Gloucestershire out seawards to a line drawn between Penarth Head in Wales and Hinckley point in Somerset. It includes subtidal and intertidal areas landward to the line of high ground and flood defences (banks and walls) that provide the limit of tidal inundation.

The Estuary is an over-arching feature which incorporates all aspects of the physical, chemical and biological attributes of the estuary as an ecosystem. The physical nature of the tidal regime determines not only the structure of the estuary and individual habitats but also the conditions affecting it and the biological communities it therefore supports.

3.1.3 Structure and Function

The Severn Estuary is important for its immense tidal range, which affects both the physical environment and the diversity and productivity of the biological communities. The tidal range is the second largest in the world, reaching in excess of 13 m at Avonmouth²⁰. This macrotidal environment is partly due to the estuary's funnel shape which concentrates the tidal wave as it moves up the Bristol Channel. Tidal currents

¹⁸ JNCC website

¹⁹ Based on Natura 2000 Standard data forms for all UK Natura 2000 sites which have estuaries as a feature- source: JNCC website <http://www.jncc.gov.uk/ProtectedSites/SACselection/habitat.asp?FeatureIntCode=H1130>

²⁰ Data on tidal range can be found on the Proudman Oceanographic Laboratory website <http://www.pol.ac.uk/ntsIf/tides/?port=0060>.

are also amplified and exceed 7 metres per second close to Avonmouth (British Geological Survey, 1996). These factors make the estuary important in representing one of the most dynamic estuarine systems in the UK, Europe and the world.

There are several major rivers, including the Taff, Usk, Wye, Severn, Avon and Parrett which feed into the estuary, and influence the salinity regime. Together these rivers tend to produce a marked east-west salinity gradient and a range of conditions varying from brackish to fully saline, depending on the season and rainfall, which in turn influences the occurrence and distribution of habitats and species throughout the estuary and its fringes.

Fine sediments which are mainly derived from erosion of the intertidal zone and suspended sediments in river water entering the estuary create high turbidity, which has its highest average level between Avonmouth and the outer part of Bridgwater Bay (British Geological Survey, 1996, ABPMer, 2006). The strong tidal currents create a highly dynamic environment and the resultant scouring of the seabed and high turbidity give rise to low diversity communities. The Severn has an extreme type of hydrodynamic and sedimentary regime which distinguishes it from other estuaries and which dominates the whole system. It is estimated that the estuary carries 10 million tons of suspended sediments on spring tides (Kirby & Parker, 1983; Kirby, 1986). Such conditions were initiated by the start of sea-level rise in late glacial times, with some evidence for steady sedimentation persisting for at least 5000 years, during which there has been a steady rise in sea level of 5 m, a trend which is continuing at present (British Geological Survey, 1996). Defra guidance²¹ indicates sea-level rise for Wales and the South West to be 3.5 mm per annum to 2025, rising to 8 mm per annum (2025-2055), 11.5 mm (2055-2085) and 14.5 mm (2085-2115).

3.1.4 Typical Habitats and Species

The extreme hydrodynamic and sedimentary conditions essentially determine the type of habitats and species present and result in characteristic animal and plant communities. Typical species for each habitat are given in the individual habitat sections.

The predominant unconsolidated sediments are muds and sands which form the basis of the structure of the estuarine habitats which include saltmarshes (section 3.5), intertidal mud and sand flats (section 3.4) and subtidal sand banks (section 3.3), mixed mud and sand, rock outcrops, boulder and shingle shores (section 3.7) as well as biogenic (worm built) reefs (section 3.6). There are also sandy beaches on the southern shores in the outer part of the estuary, backed by sand dunes.

The intertidal zone of mudflats, sandbanks, rocky platforms and saltmarsh is one of the largest and most important in Britain and this range of habitats provide an ecosystem of great importance for a wide range of fish (section 3.8) and bird (section 3.9) species – for feeding, breeding, resting and migration.

3.1.5 Natural Processes

The structure of estuaries is largely determined by geomorphological and hydrographic factors, with the original shaping forces having their beginnings in the geological origins of the adjacent land areas and the influence of major geological events such as ice ages and periods of higher and lower sea levels.

The shape of the estuaries, their macro- and micro-topography, and bathymetry, are important components of the character of the habitats and influences the distribution and abundance of marine life, *i.e.* the features' typical species. It is both determined by, and influences, natural environmental processes and consequently, can be impacted either directly or indirectly (through changes to natural processes) by man.

Estuaries are complex dynamic systems that have a natural tendency to accumulate sediment, thereby changing their form from their original Holocene morphology to a state where tidal energy is dissipated by

²¹ Defra, 2006. Flood and Coastal Defence Appraisal Guidance FCDPAG3 Economic Appraisal Supplementary Note to Operating Authorities – Climate Change Impacts October 2006

sub- and intertidal sediment banks. The width and depth of the estuary will therefore change over time towards a state of dynamic equilibrium or “most probable state”.

The velocities of currents passing through the mouth are determined partly by the tidal range and partly by the cross sectional area of the mouth itself. If these velocities are higher than the sediment erosion threshold, erosion will widen the channel and lower velocities will ensue. If velocities are lower than the sediment depositional threshold, deposition will narrow the mouth and higher velocities will ensue. In this way, an equilibrium cross section will evolve which balances tidal prism, velocities and erosion/depositional thresholds. Sea level rise means that estuaries will show a natural tendency to migrate inland (roll-over) and may erode at the mouth. Where changes in extent are attributable to the estuary adjusting to equilibrium, then the feature should be determined favourable. Where this process is constrained by hard sea defence, then this would be considered as coastal squeeze. (JNCC Common Standards Monitoring Guidance for Estuaries (version 4)).

A complex pattern and combination of physical, chemical and biological conditions and processes operates within estuaries, with many parameters varying temporally and spatially. These parameters establish the baseline conditions in the estuary and continually shape the estuaries and the habitats and wildlife they support. The key parameters are: the flood hydrograph²²; the nature of the catchment and its influence on freshwater flow and nutrient and sediment input; the nature of the estuary sediment; and the relatively high sediment levels in the estuaries resulting in low water retention within the estuary system and exposure of significant proportions of sediment at low tide. The biological communities of the estuaries have developed in response to these prevailing conditions and the daily patterns of water flow, exposure, sediment movement and water chemistry.

3.2 Subtidal sandbanks

3.2.1 Range

Sandbanks which are slightly covered by sea water all the time (subtidal sandbanks) consist of sandy sediments that are permanently covered by shallow sea water, typically at depths of less than 20 m below chart datum (but sometimes including channels or other areas greater than 20 m deep). The habitat comprises distinct banks (i.e. elongated, rounded or irregular ‘mound’ shapes) which may arise from horizontal or sloping plains of sandy sediment. Where the areas of horizontal or sloping sandy habitat are closely associated with the banks, they are included within the Annex I type.

Sandbanks which are slightly covered by sea water all the time occur widely on the Atlantic coasts of north-west Europe, and occur widely around the UK coast. They are widespread in inshore waters (within 12 nautical miles of the coast) and also occur offshore in the southern North Sea and in the Irish Sea (between 12 and 200 nautical miles).

The UK SAC series includes large sublittoral sandbanks showing good habitat structure and function. The selected sites represent the range of variation within the four main sub-types (gravelly and clean sands, muddy sands, eelgrass beds, and maerl beds), which are often associated with different physiographic features (e.g. estuaries, open coast, bays, sea lochs). The differing character of this habitat around the UK coast has also been taken into account.

The Severn Estuary subtidal sandbanks can be considered to contribute to the gravelly and clean sand sandbank resource. The Severn Estuary contributes approximately 3% of the UK Natura 2000 resource for subtidal sandbanks, by area.²³

²² A flood hydrograph is a dual plot of river discharge (line) and rainfall (bars) over time

²³ Based on Natura 2000 Standard data forms for all UK Natura 2000 sites which have estuaries as a feature- source: JNCC website <http://www.jncc.gov.uk/ProtectedSites/SACselection/habitat.asp?FeatureIntCode=H1130>

3.2.2 Extent and Distribution

The subtidal sandbanks are largely restricted to the middle and outer parts of the estuary. The sand banks of the Middle and Welsh Grounds are relatively permanent sandbank features in the Severn Estuary, along with other long established sandbank features at Cardiff Grounds and in Bridgwater Bay. The tops of these banks are intertidal, and the permanently submerged parts of the banks are considered to contribute to the subtidal sandbanks habitat.

There are other areas of subtidal sandbank habitat within the Estuary, again sometimes the top of the bank may be exposed at low tide, with the submerged sections contributing to the subtidal sandbanks habitat. These banks are more ephemeral in nature, but are still considered part of the feature, and reflect the dynamic nature of the Severn Estuary. The areas where ephemeral subtidal sandbanks are known to occur include areas offshore from Avonmouth and at English Grounds (near Clevedon).

The approximate area of the more permanent subtidal sandbanks is 1,300 hectares and there are approximately 10,440 hectares of associated ephemeral sandbanks. Areas of associated sediments have been defined by using the sediment environments of the Bristol Channel Marine Aggregates Resources and Constraints project, commissioned by the National Assembly for Wales (Posford Duvivier and ABP, 2000). Further detail is given in section 4.1.2.1.

3.2.3 Structure and Function

The subtidal area of the Severn Estuary is subject to strong tidal currents resulting in the high mobility of sediments which range from gravely to muddy sands. The high mobility of the sediments and high turbidity means that these habitats only support animals that can tolerate the shifting seabed and scouring action of suspended sand.

As described above the subtidal sandbanks habitat includes some long established and relatively permanent sandbank features and associated sediments which form more ephemeral sandbanks. The sediments of both the more permanent sandbank features and the associated sediments (ephemeral banks) together comprise the subtidal sandbanks feature of the SAC (see map in Appendix 3).

These subtidal areas play an important role in holding and supplying sediment for other habitats notably the intertidal mud and sandflats, saltmarshes and reef features and it is likely that subtidal invertebrate communities play a role as a food resource for some species of the fish assemblage feature of the SAC and Ramsar Site.

3.2.4 Typical species

The subtidal sandbanks feature has two distinct sub-features composed of communities which are determined principally by the degree of sediment mobility, grade of sediments, mix of sediments (in terms of proportions of sand and mud) and salinity.

The first sub-feature is composed of sand and muddy sand communities dominated by worms, and burrowing shrimps which can tolerate the high sediment mobility. The second sub feature is composed of mud and sandy mud dominated communities which are slightly more stable and support a greater abundance of burrowing worms.

The typical species of these communities include a range of worms, shrimps, snails and bivalves. The species diversity of these habitats is often low but overall biomass can be high.

3.2.5 Natural Processes

Subtidal sandbanks are dynamic features with their size, shape, aspect and orientation, as well as the macro- and micro-topography and sediment characteristics largely determined by the sediment supply and the influence of the hydrodynamic processes affecting each bank. They change shape over time and while some are ephemeral others may be relatively stable and long established. Mobile sediments that form temporary

sandbanks are considered to be associated sediments that should be retained in the system but their location may change.

3.3 Intertidal mudflats and sandflats

3.3.1 Range

Intertidal mudflats and sandflats are submerged at high tide and exposed at low tide. They form a major component of Estuaries and Large shallow inlets and bays in the UK but also occur extensively along the open coast and in lagoonal inlets. The physical structure of the intertidal flats ranges from mobile, coarse-sand beaches on wave-exposed coasts to stable, fine-sediment mudflats in estuaries and other marine inlets. This habitat type can be divided into three broad categories (clean sands, muddy sands and muds), although in practice there is a continuous gradation between them. Within this range the plant and animal communities present vary according to the type of sediment, its stability and the salinity of the water.

Mudflats and sandflats not covered by sea water at low tide are a widespread habitat type on coasts of Atlantic Europe, particularly around the North Sea, and occur widely throughout the UK.

Sites have been selected to encompass the range of geographical, physical and ecological variation shown by this habitat type in the UK. Examples of clean sands, muddy sands, and mudflats have all been included. Sites with large areas of intertidal flats, as well as a range of environmental conditions and an associated diversity of communities, were favoured.

The intertidal part of the Severn Estuary supports extensive mudflats and sandflats. These cover an area of approximately 20,300 ha - the fourth largest area in a UK estuary and representing approximately 7 % of the total UK resource of this habitat type (approximately 10% of the UK Natura 2000 resource for Intertidal mudflats and sandflats, by area.²⁴)

The intertidal mudflats and sandflats of the Severn Estuary are representative of estuarine mudflats and sandflats influenced by strong tidal streams and extreme silt loading.

3.3.2 Extent and Distribution

The Intertidal mudflats and sandflats feature in the Severn Estuary covers an area of approximately 20,300ha.

The Intertidal mudflats and sandflats feature is distributed throughout the Severn Estuary with extensive mudflats fronting the Welsh shore and Bridgwater Bay, and large banks of clean sands in the more central parts of the estuary at Middle and Welsh Grounds.

3.3.3 Structure and Function

This habitat type can be divided into three broad categories (which form the three main sub-features identified for this feature in the Severn Estuary), clean sands and gravels, muddy sands, and muds, although in practice there is a continuous gradation between them (Countryside Council for Wales, 2006; English Nature, 2006). The composition of the sediments and level of consolidation are the most important factors in determining the fauna of these communities and individual species distribution is largely dependant on the salinity which limits the penetration of marine species upstream where freshwater influences are strongest.

²⁴ Based on Natura 2000 Standard data forms for all UK Natura 2000 sites which have estuaries as a feature- source: JNCC website <http://www.jncc.gov.uk/ProtectedSites/SACselection/habitat.asp?FeatureIntCode=H1130>

The gravel and clean sand communities occur predominantly in the mid and upper parts of the estuary forming large banks in the centre the estuary (Frampton Sands, Lydney Sands, Oldbury Sands, Bedwyn Sands and the Welsh Grounds) through which the main tidal channel flows keeping sediments mobile.

The sandy mud communities occur in restricted locations forming the transition between the clean sand and mud communities particularly in the mid estuary and at the lowest extremes of the tide and at the flanks of the main channel.

The mud communities form in the sheltered edges of the estuary particularly where the coastline forms natural embayments and are predominantly found in the mid to outer estuary at Bridgewater Bay and on the Cardiff and Newport frontages although a narrow fringe of these communities is present throughout the estuary. These communities take the form of firm mud banks adjacent to the saltmarshes often with a liquid mud surface kept fluid by the high tidal currents.

3.3.4 Typical Species

Muddy areas in the Estuary such as those between Cardiff to Newport are generally soft and mobile, colonised by high densities of relatively few species characterised by *Hediste diversicolor* and *Macoma balthica*. Other typical species include *Nephtys hombergii*, *Hydrobia ulvae*, *Tubificoides benedii*, *Streblospio shrubsolii*, *Pygospio elegans*, and Enchytraeidae. *Corophium volutator* is also widespread in these muddy areas especially near the mudflat saltmarsh boundary. In some mid shore areas with sandier sediments *Arenicola marina*, and *Macoma balthica* are present.

Lower shore coarse sand banks such as Bedwyn and Oldbury, are dominated by mobile species such as *Bathyporeia pelagica*, *Eurydice pulchra*, and *Nephtys cirrosa*. The south side of the lower estuary has pockets of littoral muddy sand on the upper shore characterised by *Macoma balthica*, *Hydrobia ulvae*, *Bathyporeia pelagica*, and *Nephtys hombergii*. Lower down the shore the sediments become muddier and support species such as *Scoloplos armiger*, *Aphelochaeta marioni* and *Hediste diversicolor*.

Upstream of Sudbrook the infauna becomes less diverse as the salinity decreases. Mud flats here support ragworm *Hediste diversicolor*, patchy Baltic tellin *Macoma balthica* and laver spire shell *Hydrobia ulvae*, with occasional peppery furrow shell *Scrobicularia plana* near the back of the shore. Within the pills along the site and in the upper reaches towards the road crossing the soft mud often supports few species including *Hediste diversicolor* and *Oligochaeta* spp.

The high biomass of invertebrates in the mudflats of the Severn provide an important food source for a diverse range and large number of fish and benthic predators. These intertidal areas are therefore important in supporting the fish assemblage subfeature of the SAC and Ramsar Site.

Mudflats also provide a valuable feeding, roosting and resting area for a wide range of species of wading birds and waterfowl and are therefore important supporting habitats for the wintering and passage bird features of the SPA and Ramsar Site.

3.3.5 Natural Processes

Intertidal mudflats and sandflats are dynamic features. Their distribution, extent, shape, topography, aspect and orientation is the product of complex interaction between hydrodynamic and sediment transport processes, sediment supply and coastal morphology. Hydrographic functions that structure intertidal mudflats and sandflats encompass highly dynamic hydrodynamic and other properties that vary with short and long-term natural cycles, climate influences and stochastic events.

The structure of intertidal mudflats and sandflats varies depending on the physical conditions and forces acting on them (in particular the degree of exposure to wave action and tidal currents) as well as the nature of the sediments occurring in any one location. The sediments vary from mobile coarse sand in more wave exposed areas to stable, fine sediment expanses of mudflat in estuaries and other marine inlets.

Intertidal mudflats and sandflats support a variety of different wildlife communities. These are predominantly infaunal communities of a variety of different animal species such as worms, molluscs and crustaceans living within the sediment habitat. The type of sediment, its stability and the salinity of the water have a large influence on the wildlife species present.

3.4 Atlantic salt meadow

3.4.1 Range

Atlantic salt meadows develop when halophytic vegetation colonises soft intertidal sediments of mud and sand in areas protected from strong wave action. This vegetation forms the middle and upper reaches of saltmarshes, where tidal inundation still occurs but with decreasing frequency and duration. A wide range of community types is represented and the saltmarshes can cover large areas, especially where there has been little or no enclosure on the landward side. The vegetation varies with climate and the frequency and duration of tidal inundation. Grazing by domestic livestock is particularly significant in determining the structure and species composition of the habitat type and in determining its relative value for plants, for invertebrates and for wintering or breeding waterfowl.

This Annex I type is predominantly found on Atlantic coasts in western Europe. Atlantic salt meadows occur on North Sea, English Channel and Atlantic shores. There are more than 29,000 ha of the habitat type in the UK, mostly in the large, sheltered estuaries of south-east, south-west and north-west England and in south Wales. Smaller areas of saltmarsh are found in Scotland.

Sites have been selected to cover the geographical range and ecological variation of Atlantic salt meadows in the UK. The sites selected are for the most part the largest examples of this habitat type, with good structure and function, and which support a well-developed zonation of plant communities within the saltmarsh. There are transitions to other high-quality habitat assemblages at many of the sites that have been selected. Sites with complete sequences of vegetation and transitions to other habitats, such as sand dunes, represent the range of variation of the habitat type, and this has been an important consideration in site selection.

The Severn Estuary holds the largest aggregation of saltmarsh in the south and south-west of the UK. It covers approximately 1,400 ha, representing about 4% of the total area of saltmarsh in the UK (Dargie, 2000).

3.4.2 Extent and Distribution

The Severn Estuary is fringed by saltmarsh. The huge tidal range in the Severn Estuary has led to extensive saltmarsh community development with an expanded zonation.

3.4.3 Structure and Function

The saltmarshes of the Severn Estuary have four principal zones corresponding to the four main sub-features that have been identified for this feature. Two of these zones (the lower to mid marsh communities and the mid to upper marsh communities) contain the principle saltmarsh types which are defined as Atlantic salt meadow as per the Annex 1 habitat description. However these occur in an intimate mosaic and in transition with the communities of the other two zones (in the pioneer saltmarsh and transitional high marsh communities) which are therefore considered in this advice as part of the feature. Section 4.1.4.1 and Table 11 provide further details of these zones and their typical species.

The pioneer saltmarsh communities play an important role in saltmarsh development as colonising plants (*eg Spartina sp. and Salicornia sp.*) stabilise and trap sediments. The upper marsh transitions to terrestrial and freshwater habitats support a range of nationally scarce and uncommon plant species and support tidal debris strandlines of value for invertebrates which are important components of the estuary feature.

Some of the saltmarshes show a sequence of saltmarsh cliffs or steps related to past cycles of accretion and erosion and in places the saltmarshes are also cut transversely by “pills” where freshwater streams enter the estuary. These features add diversity to the saltmarsh by initiating new patterns of species zonation. Recent monitoring has identified that there is a complicated present day pattern of erosion and accretion of the saltmarshes throughout the estuary and some parts appear to be exhibiting the effects of coastal squeeze – the constriction of saltmarsh habitats between rising sea levels and hard defences at the back of the saltmarsh .

Saltmarshes and mudflats have an important role to play in estuarine processes, both through the recycling of nutrients within the estuary and through their role as soft sea defences, dissipating wave energy. They are highly productive biologically, providing organic material that support other features within the marine ecosystem and they also have an important physical role, acting as a sediment store to the estuary as a whole.

Saltmarshes also provide a valuable feeding and roosting and resting areas (particularly at high tide) for a wide range of species of waterfowl and are therefore very important supporting habitats for the wintering and passage bird features of the SPA and Ramsar Site. The habitats within the “pills” provide important shelter and feeding habitats for both fish and bird species.

The Severn Estuary saltmarshes are generally grazed by sheep and/or cattle. Grazing is a significant factor in determining the plant communities found within them and their value for dependant species such as birds and rare plants.

3.4.4 Typical Species

The saltmarsh communities present relate to the four principal zones referred to above.

The low to mid marsh communities include transitional low saltmarsh with *Puccinellia maritima*, annual *Salicornia* sp. and *Suaeda maritima*; *Aster tripolium* (rayed) saltmarsh; *Puccinellia maritima* saltmarsh; *Atriplex portulacoides* saltmarsh; and *Juncus maritimus* - *Triglochin maritima* saltmarsh.

The mid to upper marsh communities include *Festuca rubra* saltmarsh; *Artemisia maritima* saltmarsh; and *Juncus maritimus* salt-marsh.

The transitional high marsh communities include *Spergularia marina* - *Puccinellia distans* saltmarsh; *Elytrigia atherica* saltmarsh; *Elytrigia repens* saltmarsh; *Festuca rubra* - *Agrostis stolonifera* - *Potentilla anserina* inundation grassland; *Festuca arundinacea* coarse grassland; *Agrostis stolonifera* - *Alopecurus geniculatus* inundation grassland; *Phragmites australis* reedbed; *Bolboschoenus maritimus* swamp; and *Agrostis stolonifera* sub-community.

The pioneer saltmarsh communities include *Spartina anglica* saltmarsh; Annual *Salicornia* saltmarsh; and *Suaeda maritima* saltmarsh.

Several notable species are also present *Alopecurus bulbosus*, *Althaea officinalis*, *Bupleurum tenuissimum*, *Hordeum marinum*, *Puccinellia rupestris*, *Trifolium squamosum*, *Lepidium latifolium*, *Allium oleraceum*, and *Petroselinum segetum* (Dargie 1998).

3.4.5 Natural Processes

The location, character, and dynamic behaviour of saltmeadows are governed by four physical factors: sediment supply, tidal regime, wind-wave climate and the movement of relative sea level. There are four elements necessary for the development and growth of a salt marsh: (1) a relatively stable area of sediment that is covered by the tide for a shorter period than the time it is exposed; (2) a supply of suitable sediment available within the period of tidal cover; (3) water velocities that are sufficiently low for some of the sediment to settle out; and (4) a supply of seeds or other propagules for the establishment of vegetation cover.

The topography and microtopography of areas of Atlantic salt meadow are the product of complex interaction between hydrodynamic and sediment transport processes, sediment supply and coastal

morphology. These can be highly dynamic and vary with short and long-term natural cycles, climate influences and stochastic events, including: tidal range and excursion, salinity, water temperature and suspended particulate concentrations.

The marsh-edge morphology provides information on the short to medium term trends of marsh morphodynamics. Accreting and stable seaward marsh edges have an accretional ramp upon which pioneer and low-marsh vegetation can become established. Erosional margins are characterised either by the presence of mud-mound topography or by marsh-edge cliffs fronted by toppled cliff blocks with live or dying vegetation, rotational slide or overhanging (cantilever) blocks. Terraced marsh margins indicate episodic erosion and accretion on timescales over decades to centuries.

The Severn Estuary saltmarshes do not generally contain a pattern of creeks and pans more typical of extensive saltmarshes in estuaries with less extreme tidal ranges. Instead the saltmarshes are dissected by “pills” (steep sided natural drainage channels cutting through the saltmarsh) where freshwater streams flow into the estuary. These are often deep and steep sided funnel shaped features, often with pioneer vegetation established along their banks although in many cases the natural structure of the pill is truncated by tidal flaps or flow valves. In a few locations natural salt pans occur within the saltmarshes.

Major erosion of saltmarsh is indicated by internal dissection and enlargement of the drainage network, ultimately leading to the creation of mud basins.

Nutrient levels are a strong influence on the growth of estuarine saltmarsh plants. Nutrient cycling within saltmarshes can also have a significant effect on coastal and estuarine water quality. In this respect, healthy, functional saltmarsh habitat may have an important role to play in the control of nutrients, which are important in determining water quality.

Given favourable conditions, depending on sediment supply and hydrodynamic regime, mudflats evolve into saltmarshes by way of substrate stabilisation by algae, diatoms and early pioneer plants, giving rise to enhanced sediment accretion rates.

3.5 Reef

3.5.1 Range

Reefs are rocky marine habitats or biological concretions that rise from the seabed. They are generally subtidal but may extend as an unbroken transition into the intertidal zone, where they are exposed to the air at low tide. Intertidal areas are only included within this Annex I type where they are connected to subtidal reefs. Reefs are very variable in form and in the communities that they support. Two main types of reef can be recognised: those where animal and plant communities develop on rock or stable boulders and cobbles, and those where structure is created by the animals themselves (biogenic reefs).

Rocky reefs are extremely variable, both in structure and in the communities they support. A wide range of topographical reef forms meet the EU definition of this habitat type. These range from vertical rock walls to horizontal ledges, sloping or flat bed rock, broken rock, boulder fields, and aggregations of cobbles. In contrast to the variety of rocky reefs, there is somewhat less variation in biogenic reefs, but the associated communities can vary according to local conditions of water movement, salinity, depth and turbidity. The main species which form biogenic reefs in the UK are blue mussels *Mytilus edulis*, horse mussels *Modiolus modiolus*, ross worms *Sabellaria* spp., the serpulid worm *Serpula vermicularis*, and cold-water corals such as *Lophelia pertusa*.

Reefs occur widely around the UK coast, and are found in both inshore and offshore waters. There is a far greater range and extent of rocky reefs than biogenic concretions. Only a few invertebrate species are able to develop biogenic reefs, and these have a restricted distribution and extent in the UK.

The Severn Estuary has areas of biogenic reefs, formed by the tube-dwelling polychaete worm *Sabellaria alveolata*. *Sabellaria alveolata* reefs in the UK are predominantly an intertidal habitat but the Severn Estuary

is one of the few places where *Sabellaria alveolata* reefs occur extensively in the subtidal, as well as the intertidal.

3.5.2 Extent and Distribution

There are patches of intertidal *Sabellaria alveolata* reef throughout the Estuary, although it tends to be more common on the English side. The subtidal *Sabellaria alveolata* tends to be in the outer parts of the Estuary, southwest of a line between Clevedon and Newport. The exact distribution of subtidal *Sabellaria alveolata* reef in the Severn Estuary is unknown, partly due to the difficulties in sampling this habitat.

3.5.3 Structure and Function

Sabellaria alveolata is a species of small worm which constructs tubes using sand particles, to build honeycomb-like structures. *Sabellaria alveolata* reefs are often also known as honeycomb worm reefs.

These biogenic reefs tend to increase habitat diversity for other species (Holt et al 1998), sometimes leading to higher species diversity within *Sabellaria* reefs compared to the surrounding sediment or rock habitats (Dubois et al 2002). *Sabellaria alveolata* reefs cycle through different phases, from newly settled worms through vigorous fast growing reef to older, more biodiverse hummocks (Cunningham et al, 1984). At other sites each of these phases tends to have a different community of plants and animals associated with it, so all phases are considered important for biodiversity (Collins, 2001; Dubois et al, 2002).

In order to thrive, *Sabellaria alveolata* requires an abundance of suitable coarse sand to support tube building (and therefore reef growth), as well as the availability of suitable substrates (pebbles, cobbles, boulders, bedrock) to attach to. Larval supply is also important and *Sabellaria* larvae are thought to stay in the water column for one to six months (Jackson 2008). The worms are filter feeders and therefore food within the water column (suspended detritus material) is also needed. *Sabellaria* larvae are thought to settle preferentially in areas where *Sabellaria* reef has been present in the past (Holt et al, 1998).

3.5.4 Typical Species

The *Sabellaria alveolata* reef biotopes which have been recorded in the Severn Estuary are *Sabellaria alveolata* on variable salinity sublittoral mixed sediment and *Sabellaria alveolata* reefs on sand-abraded eulittoral rock.

In the Severn Estuary (both subtidal and intertidal) the presence of *Sabellaria alveolata* reefs generally increases species diversity, relative to the surrounding rock or sediment, although the diversity of *Sabellaria alveolata* reefs in the Severn is still thought to be comparatively low compared to other areas of the UK. Species commonly found associated with subtidal *Sabellaria alveolata* reef from infaunal samples include *Eulalia tripunctata*, *Mediomastus fragilis*, *Typosyllis armillaris*, *Melinna cristata*, *Harpinia pectinata*, *Ampharete grubei*, *Golfingia vulgaris*, *Pygospio elegans*, *Arenicola marina*, *Autolytus sp*, *Sphenia binghami* and *Harmothoe impar* (Mettam et al. 1994 and Marine Recorder database).

Species found in intertidal *Sabellaria alveolata* reefs in the Severn Estuary at Goldcliff and Lavernock point include *Crangon crangon*, *Actinia equina*, *Cancer pagarus*, *Porcellana platycheles*, *Littorina spp.*, *Pholas dactylus*, *Elminius modestus*, *Fucus serratus*, *Corralina officinalis* and *Enteromorpha spp.* (O'Riordan, 2006).

3.5.5 Natural Processes

Little is known about the nature of the *Sabellaria alveolata* reef in the Severn Estuary, especially in the subtidal. However, at other sites *Sabellaria alveolata* is known to have a very variable recruitment and the cover in any one area may vary greatly over a number of years (Wilson, 1974). A typical life span of 4-5 years for worms in colonies forming reefs on bedrock and large boulders has been reported from other areas (Wilson, 1971), with a likely maximum of around 9 years (Gruet, 1982; Wilson, 1971). However, it is suspected that there are many colonies on intertidal cobble and small boulder scars on moderately exposed shores where shorter lifespans are likely due to the unstable nature of the substratum (Holt et al, 1998). As

mentioned above, *Sabellaria alveolata* reefs cycle through several different phases, all of which are considered important for biodiversity.

3.6 Other estuarine habitats : Hard substrate habitats (rocky shores) and eel grass beds

3.6.1 Extent and Distribution

There is approximately 1,500 ha of hard substrate habitat within the Severn Estuary, consisting of boulders, rock, mussel/cobble scars, rocky pools and shingle (Countryside Council for Wales, 2006; English Nature, 2006). The largest areas of hard substrate are located towards the outer estuary at Brean Down, Anchor Head and Sand Point together with rocky platforms and cliffs at Clevedon and Portishead. There are also extensive rock platforms at English stones, Aust and Beachley.

Beds of eelgrass (*Zostera* spp.), the largest in Wales, occur on some of the more sheltered mixed hard substrate areas around the Welsh side of the Second Severn Crossing.

3.6.2 Structure and Function

Hard substrate habitats in the Severn Estuary display different characteristics to other areas in Wales. Where there is bedrock, fucoid algae cover is dense but with little associated flora and fauna. Areas of soft clay rock around Penarth also support the boring bivalves *Barnea candida* and *Pholas datylus*. Pebble and cobble shores tend to be dominated by barnacles mostly *Elminius modestus*, and sparse rough periwinkles and winkles. In the sublittoral fringe on bedrock, cobbles and pebbles, hydroids, bryozoans, sponges and barnacles dominate. These species form communities that are usually associated with subtidal habitats (adapted from Brazier et al 2007).

These habitats provide a wide range of services for estuarine species. They are important components of the SAC Estuary feature, important supporting habitats for the wintering and passage bird features of the SPA and Ramsar Site and also important supporting habitats for the fish assemblage of the SAC and Ramsar designations.

Seagrass beds are one of the most productive habitats of shallow water coastal ecosystems supporting large numbers of algae, invertebrates and fish and are an important food source for several species of ducks and geese including wigeon and European white-fronted geese. The *Zostera* beds in the Severn are unusual in that they occur in an area of mixed cobbles, sand and mud with large boulders, in other parts of Wales they are associated with mudflats. Both species of *Zostera* occur within the bed. On more dry elevated areas of sediment *Zostera noltii* can be found, whereas wet depressions and channels are dominated by *Zostera marina*. *Zostera* coverage can be patchy but locally abundant. Hard substrata within the *Zostera* bed is dominated by fucoid algae, ephemeral green algae and barnacles.

3.6.3 Typical Species

Typical fauna and flora of rocky and mixed shore areas of the Severn include spiral wrack, bladder wrack, eggwrack and serrated wrack, periwinkles, limpets, barnacles and whelks. On lower shore rock, cobbles and pebbles barnacles dominate including the barnacle *Balanus crenatus* and hydroids *Tubularia indivisa* and *Sertularia cupressina* the bryozoan *Alcyonidium diaphanum* and mermaids glove sponge *Haliclona oculata*.

Both species of eelgrass, *Zostera marina*, and *Z. noltii* have been recorded in the estuary. These are of restricted distribution in British estuaries. It is unusual to have both species in one location.

3.6.4 Natural Processes

The extent and distribution of the rocky shore habitat is largely determined by the underlying geology and sedimentology, along with orientation and aspect and the influence of the prevailing physical conditions such as the degree of exposure to wave action and tidal currents. These factors, combined with the influence of others, such as water quality (including turbidity) and sediment chemistry, influence the assemblages of marine species associated with the different rocky habitats throughout the estuary.

Seagrass beds typically occur in sheltered environments such as shallow inlets and are usually found on soft sediments. The *Zostera* beds in the Severn are unusual in that they occur in an area of mixed cobbles gravel sand and mud.

3.7 Fish

3.7.1 Introduction

The fish fauna of the Severn Estuary is very diverse (Potts & Swaby 1994, Bird 2008). More than 110 species of fish have been identified including a wide range of migratory species and estuarine specialists and some more typically marine and freshwater species reflecting the influence of the wider Bristol Channel and major rivers entering the estuary (Severn, Wye, Usk, Avon Parrett).

3.7.2 Fish features of the Severn Estuary European Marine Site

The Severn Estuary is of particular importance for migratory fish. The estuary is one of the most important British estuaries for three rare species - river lamprey *Lampetra fluviatilis*, sea lamprey *Petromyzon marinus* and twaite shad *Alosa fallax* which are designated features of the SAC. These species together with salmon *Salmo salar*, sea trout *Salmo trutta*, eel *Anguilla anguilla* and allis shad *Alosa alosa* are also a designated feature of the Ramsar Site.

The wider assemblage of fish species, which includes the migratory species, estuarine specialists and the more typically marine and freshwater species, is a designated feature of the Ramsar Site and a component of the estuary feature of the SAC.

3.7.3 Supporting habitats

The estuary habitats, tidal stretches of the feeding rivers and saltmarsh morphological features such as drainage channels, known locally as “pills” and “rhines” (“reens” in Wales) provide important feeding, breeding and sheltered nursery areas for a wide range of fish.

3.7.4 Migratory fish

The river and sea lamprey are a primitive type of fish having a distinctive suckered mouth but no jaws. Although numbers of lamprey have declined over the last 100 years, the UK is still one of their strongholds. Sea and river lampreys spend their adult life in the sea or estuaries but spawn and spend the juvenile phase in rivers. They use the Severn Estuary as a migratory passage to and from their spawning and nursery grounds in the rivers.

Allis and twaite shad are the only two members of the herring family found in fresh water in the UK. Both look like large herring and were formerly eaten in this country before numbers declined and the fisheries collapsed. In the middle of the 19th Century, the value of shad rivalled that of salmon, and in the River Severn, shad made up about one-third of all catches. Three of the four confirmed UK spawning populations of twaite shad are in the rivers Severn, Usk and Wye respectively. The major part of the spawning population of Twaite shad consists of fish that have spawned and passed up and down through the estuary more than once. The shad enter estuaries in spring and move up into the rivers to spawn. The estuary serves as a nursery area for juvenile shad where they feed on plankton.

The Severn Estuary supports an important run of migratory salmon and sea trout which pass through the estuary on their way to and from their spawning grounds in the upper reaches of the rivers and the open sea. The Severn Estuary has the largest eel run in Great Britain.

3.7.5 Assemblage of fish species

The assemblage of fish species includes the migratory species (referred to in section 3.8.4 above), as well as the following:

- Estuarine species
 - o Species typically occurring and breeding in estuaries (Bird, 2008)
 - o Marine species occurring in large numbers in estuaries (Bird, 2008)
- Marine species
 - o Predominantly marine species occurring infrequently in the Severn (Bird, 2008)
- Freshwater species
 - o Species typically occurring and breeding in freshwater and recorded within the Severn cSAC (Bird, 2008)

Estuarine species

These species of fish rely on the estuary for some aspect of their life-cycle. As a result of this dependence, these species are often the most vulnerable to anthropogenic and environmental factors that could affect the habitat and ecology of the estuary. Marine species occurring in large numbers in estuaries are all marine species who spend the first few years of life in the sheltered waters of the estuary where suitable food is abundant and there are fewer predators. The Severn Estuary ranks as one of the top ten estuaries in the UK for the number of marine estuarine-opportunistic species it supports (Potts & Swaby 1993). Marine estuarine-opportunists can be present in the estuary in very large numbers at particular times of year. These include sprat, herring, whiting, bib, poor cod, bass and common goby (Bird, 2008).

There are a few species that spend their entire life-cycle within the estuary. These include common goby, black goby, sand smolt and 3- spined stickleback (Bird, 2008).

Marine species

These fish normally spend their entire life-cycle in the sea and only occasionally enter estuaries. Therefore, they have only a minor role to play in the estuarine ecosystem. Thus, only four species, the conger eel, Norway pout, red mullet and plaice; are ever caught in numbers exceeding about 10 per year in power station samples. They probably have little impact, either as prey or as predators on other estuarine species. While they add to the biodiversity of the fish assemblage, their main populations occur in the sea. (Bird, 2008)

Freshwater species

These species typically occur and breed in freshwater, but have occasionally been recorded within the Severn Estuary. The specimens recovered at Oldbury and/or Berkeley power stations are presumably fish that have inadvertently been swept downstream and entered brackish water. They include perch, three-spined stickleback, tench, roach and chub. The numbers of freshwater species recovered at Oldbury is always low, and usually related to increases in fresh water discharge in the spring and autumn months after heavy rain. The only exception to this generalisation concerns the three-spined stickleback which occurs in considerable numbers at Oldbury and can be regarded as both a freshwater and an estuarine species (Bird, 2008)

3.8 Birds

3.8.1 Introduction

Many estuaries in the UK are of great importance to migratory and wintering wildfowl and waders. The Severn Estuary forms part of the complex chain of estuary sites along the western coast of the UK that provide habitats for migratory waterfowl. The relatively mild winter weather conditions found here compared to continental Europe at similar latitudes can be of additional importance to the survival of wintering waterfowl during periods of severe weather. It is especially important when there is severe weather affecting other sites further north and on the east coast of Britain.

The Severn Estuary ranks amongst the top ten British estuaries for the size of visiting waterfowl populations that it supports over winter (Musgrove *et. al.*, 2001). Outside of this period, it is of particular importance as a staging area in autumn and spring for migratory waterfowl species as it lies on the East Atlantic Flyway route. Bird communities are highly mobile and exhibit patterns of activity related to tidal water movements and many other factors. Different bird species exploit different parts of a marine area and different prey species.

3.8.2 Bird features of the Severn Estuary European Marine Site

The migratory wintering and passage populations of birds in the Severn Estuary are designated features of the SPA (see section 2.2) and Ramsar Site (see section 2.3) which supports in excess of 70,000 birds in winter. These include internationally and nationally important populations of key bird species in winter for which the UK has particular importance in both Europe and the world. The bird assemblage is also part of the Estuaries feature of the SAC.

3.8.3 Low-tide distribution of waterbirds on the Severn Estuary SPA and Ramsar Site

Natural England and the CCW commissioned the British Trust for Ornithology (BTO) to organise, as part of the series of WeBS Low Tide Counts, a complete low tide survey of the Severn Estuary during the winter of 2002/03 (Burton *et al.*, 2003). The mean numbers and distribution of total waterbird species recorded on each count section on the Severn Estuary in the winters 1987/88 to 1991/92 and in 2002/03 from this BTO low-tide count data for various individual species and the bird assemblage are illustrated in Appendix 9. The Figures generally indicate that the waterfowl are distributed extensively across virtually the entire intertidal area with some obviously high concentrations in specific areas.

These maps are indicative only and several constraints on their use should be noted when attempting to interpret them. Firstly, it should be noted that in each winter only a maximum of four counts were made of each count section, one a month from November to February. Observation of the central areas of the estuary is also very difficult with all observations being made from land and it is possible that the numbers of birds using these areas were underestimated. Gulls were only recorded in the 2002/03 survey. However, even in that survey, coverage of these species was patchy. The Severn is a highly dynamic estuary and thus the location and extent of many of the intertidal areas may have changed since the Ordnance Survey maps used for this project were created. The movements of sediments may potentially also cause marked differences in the distributions of invertebrates and thus waterbirds between years. It should also be noted that the numbers of birds recorded on the Severn Estuary may vary annually due to weather conditions. In cold winters, the west coast of Britain may act as a refuge for many waterbirds that in milder winters would occur on the east coast or on the Continent. In cold winters, therefore, waterbirds may be more widely distributed across the estuary than they would in milder winters. Lastly, in assessing the importance of different intertidal mudflats, it is also essential to note that some species may use different areas during the night to those where they are recorded in the day.

3.8.4 Relationship between bird populations and supporting habitats

In recognition of the fact that bird populations on a site may change in response to wider national or international trends or events, this Regulation 33 advice addresses the habitat conditions on the site necessary to support the bird populations, as well as the bird populations themselves. "Supporting habitats" are

identified which describe the key habitats within the European Marine Site necessary to support the interest features i.e. the qualifying bird species (see Table 3 for the SPA and Tables 5 and 7 for the Ramsar Site. The Favourable Condition Tables (section 4.2; Table 15 for the SPA and Section 4.3 Table 20 for the Ramsar Site) contain further details on habitat conditions.

The key supporting habitats are the intertidal mudflats and sandflats, saltmarshes and hard substrate habitats (rocky shores). Reference should also be made to sections of this document that relate to the Severn Estuary SAC interest features which provides advice in respect of these habitats (section 4.1 and Tables 8, 10 and 11).

Bird communities are highly mobile and exhibit patterns of activity related to tidal water movements and many other factors. Different bird species exploit different parts of a marine area and different prey species. Changes in the habitat may therefore affect them differently. The most important factors related to this are:

- current extent and distribution of suitable feeding and roosting habitat (eg saltmarsh, mudflats, shingle and rocky shores);
- sufficient prey availability (eg crustaceans, small fish, molluscs, worms and seeds);
- levels of disturbance maintained at or below levels necessary to provide favourable conditions for birds' feeding and roosting areas;
- water quality necessary to maintain intertidal plant and animal communities; and
- fresh water quantity, tidal flows, salinity gradients and grazing necessary to maintain saltmarsh conditions suitable for bird feeding and roosting.

There are also a number of habitats, such as the wet coastal grazing marsh, improved grassland and open standing waters that support the qualifying bird species and occur within the SPA and Ramsar Site boundary. However, these habitats lie above highest astronomical tide and therefore are not within the European Marine Site. Objectives to maintain these aspects of bird interest in favourable condition are found within Natural England and CCW's conservation objectives for the relevant SSSI within the SPA and Ramsar site boundary and will be dealt with through relevant procedures outlined in the Conservation (Natural Habitats &c.) Regulations 1994.

Some species will also use areas of land and coastal waters outside the boundaries of both the European Marine Site, SPA and Ramsar Site. Relevant authorities need to have regard to such adjacent interests, as they might be affected by activities taking place within, or adjacent to the European Marine Site.

3.8.5 Bird count data and assessing condition of bird features and their habitats

Natural England and CCW's conservation objectives at the site level focus on maintaining both the populations of the qualifying species and the habitats used by them. Site management should therefore aim to avoid both damage to the supporting habitats and disturbance to the birds. In reporting on the conservation status, account will need to be taken of both habitat conditions and the status of the bird populations.

Accordingly, Natural England and CCW will use annual counts, in the context of five year peak means for qualifying species, together with available information on population and distribution trends, to assess whether an SPA is continuing to make an appropriate contribution to the Favourable Conservation Status of the species. Count information will be assessed in combination with information on habitat condition, at the appropriate time within the reporting cycle, in order to report to the European Union.

In addition to focusing on avoiding deterioration to the habitats of the qualifying species, the Habitats Directive also requires that actions be taken to avoid significant disturbance to the species for which the site was designated. Such disturbance may result in alterations in population trends and/or distribution patterns. Avoiding disturbance to species requirements is mentioned in the favourable condition table accompanying the conservation objectives for the SPA and Ramsar Site (Tables 16 and 21). In this context, five-year peak mean information on populations will be used as the basis for assessing whether disturbance is damaging.

Attention is also directed to the inclusion of disturbance in the advice on operations provided in Section 5. Where disturbance is highlighted in such advice, relevant authorities need to avoid damaging disturbance to qualifying species when exercising their functions under the Directive.

3.8.6 Description of the Severn Estuary bird features and their supporting habitats

3.8.6.1 Internationally important populations of waterfowl

This comprises:

- A. Internationally important populations of regularly occurring Annex 1 species : Bewick's Swan
- B. Internationally important populations of regularly occurring migratory species of the SPA
- C. Internationally important populations of waterfowl of the Ramsar Site

A. Annex 1 species of the SPA

Description of the Feature

The species listed in Annex 1 of the Birds Directive are the subject of special conservation measures concerning their habitat in order to ensure their survival and reproduction in their area of distribution. Species listed on Annex 1 are in danger of extinction, rare or vulnerable. Annex 1 species that regularly occur at levels over 1% of the national population meet the SPA qualifying criteria. The Severn Estuary SPA supports internationally important populations of one Annex I species

- **Bewick's swan** *Cygnus columbianus bewickii*
(Note : this species is also part of C. internationally important populations of waterfowl of the Ramsar Site)

Key supporting habitats for Bewick's swan

Intertidal mudflats and sandflats - The focal area for the Bewick's swans is the upper Severn Estuary in the vicinity of the New Grounds, Slimbridge area. The mudflats and sandflats exposed as the tide falls where the estuary widens in the upper reaches of the site at Waveridge Sands, Frampton Sands and The Noose are used as a safe refuge areas when the birds are disturbed.

Saltmarsh communities - The birds feed on the saltmarsh and the transition from saltmarsh to coastal grazing marsh in front of the sea defences in the upper estuary at The Dumbles, where areas of the high marsh are mainly affected only by brackish water during tidal inundation. They favour areas that have unrestricted views for the early detection of predators.

Bewick's swan graze on a range of 'soft' meadow grasses such as *Agrostis stolonifera* and *Alopecurus geniculatus* found in wet meadows which are outwith the European Marine Site boundary.

- B. Internationally important populations of regularly occurring migratory species of the SPA and**
C. Internationally important populations of waterfowl of the Ramsar Site

Description of the features

Migratory species that regularly occur at levels of 1% or more of the total biogeographic population meet the SPA criteria and qualify for designation in their own right.

Wintering species that regularly occur at levels of 1% or more of the total biogeographic population meet the Ramsar criteria (3c) and qualify for designation in their own right.

The following qualifying species of both the SPA and Ramsar are:

- **European white-fronted goose** *Anser albifrons*
- **Dunlin** *Calidris alpina alpina*
- **Redshank** *Tringa totanus totanus*
- **Shelduck** *Tadorna tadorna*
- **Gadwall** *Anas strepera*

Note : previous Regulation 33 advice issued in respect of the Severn Estuary SPA in February 2005 excluded gadwall as they were considered not to make use of the European Marine Site to any significant degree but further recent evidence (2000/01 Low Tide Bird Counts) has demonstrated that this species does make use of the EMS and has consequently now been included.

Key supporting habitats

Intertidal mudflats and sandflats - The extensive mudflats and sandflats of the Severn Estuary provide undisturbed refuge and a rich resource of intertidal invertebrates as food for many species of migratory birds. The Severn supports massive populations of birds, many of which are highly mobile, feeding and roosting in different areas, depending on food availability and the state of the tide.

The European white-fronted geese roost at night on estuarine sandbanks and usually fly less than 10km to the daytime feeding grounds. Therefore conservation of traditional roosting sites is necessary to enable the population to exploit potential feeding habitats. The sandbanks adjacent to the New Grounds at Slimbridge are a long established, traditional wintering area for the European white-fronted geese (Owen *et al.*, 1986) where they use Waveridge Sand, Frampton Sand and the Noose. Only occasionally will small numbers occur at other localities within the Severn Estuary. Shelduck exploit the rich resources of invertebrates found in the intertidal mudflats where they forage for molluscs and other invertebrates such as the mudsnail *Hydrobia* spp, mussels *Mytilus edulis* and small crustaceans such as the common shore crab *Carcinus maenas*. They feed in groups, and are distributed widely throughout the estuary where there are extensive areas of intertidal flats, but there are major concentrations on Bridgwater Bay, around the mouth of the Rhymney river and, prior to construction of the Cardiff Barrage, in Cardiff Bay (Ferns, 1980a; Fox & Salmon, 1988a; Clarke, 1989; WWT Wetlands Advisory Service, April 2003). Bridgwater Bay is a long established traditional moulting area for shelduck during late summer and autumn (Eltringham & Boyd, 1960, 1963; Morley, 1966; Fox & Salmon, 1988a). It is the largest single moulting area in Europe away from Waddensea.

Redshank and dunlin are distributed widely and feed throughout the estuary on marine polychaete worms, crustaceans and molluscs such as the Baltic tellin *Macoma balthica*. They frequently feed along undisturbed strandlines throughout the estuary. They favour areas that have abundant invertebrate prey species and unrestricted views for the early detection of predators. The location of

feeding birds on the intertidal flats is a reflection of the invertebrate species found there which, in turn, are dependent on the sediment type. Dunlin and redshank mainly feed on invertebrates in the muddier finer sediments. Dunlin are found mostly on the mid shore whereas redshank are more thinly distributed and are often found in smaller groups in the creeks and sub-estuaries. The Severn has the third largest wintering population of Dunlin in Britain. Feeding flocks are widely distributed around the estuary particularly downstream of the first Severn Bridge, with particular concentrations at Rhymney/Peterstone, Uskmouth, Welsh Grounds, Undy, Clevedon and Bridgwater Bay (Ferns, 1977; Mudge, 1979; Ferns, 1980a; Clark, 1989). There are notable concentrations of redshank at the mouths of the Rhymney, Wye, Avon and Parrett rivers (Ferns, 1977, 1980a; Clark, 1989; WWT Wetlands Advisory Service, April 2003).

Gadwall are predominantly a freshwater species preferring the wetland habitats that occur within the SPA behind the flood defences and therefore outside the European Marine Site- most notably the freshwater wetlands at Slimbridge and Bridgwater bay. However, they do make use of the estuary but this is largely restricted to areas where freshwater flows come into the estuary, particularly larger rivers and ponds- most notably at Avonmouth, between the two Severn Bridges and at Woodspring and Weston Bays.

Saltmarsh - Upper and lower saltmarsh provide important feeding and roosting areas for the internationally important migratory birds throughout the estuary. The saltmarshes provide a rich feeding habitat for redshank and shelduck, which feed on invertebrate species in the sediments, such as the mudsnail *Hydrobia*. The European white-fronted geese graze on a range of saltmarsh grasses and herbs such as common saltmarsh grass *Puccinellia maritima* and sea barley *Hordeum marinum*. The birds feed on the saltmarsh and the transition to coastal grazing marsh in front of the sea defences in the upper estuary and particularly at the The Dumbles.

The saltmarshes also have an important function providing a safe haven from the tides that flood the mudflats twice a day. The low-growing dense vegetation provides a suitable roosting habitat for redshank and dunlin, which prefer to roost on areas of short vegetation ensuring good visibility. The saltmarshes throughout the estuary provide an important communal roosting site for redshank, dunlin and shelduck. Upper saltmarsh in particular makes ideal highwater roost sites and there are main high tide roosts in some areas with little human disturbance where waders congregate from their feeding areas.

Hard substrate habitats (rocky shores) - the shingle and rocks in the estuary provide feeding areas for dunlin and redshank and some limited foraging at high tide. It also provides important roost sites at high tide particularly for the dunlin and redshank. Many of the rocks are off shore and are therefore generally free from human disturbance. These include Guscar Rocks in the upper reaches, Blackstone Rocks at Clevedon and Stert Island in Bridgwater Bay.

Freshwater coastal grazing marsh, improved grassland and open standing waters – these supporting habitats lie outside the European Marine Site boundary but within the SPA. They provide key areas for feeding and roosting for all the migratory species particularly at high tide, and mainly on the English side of the Estuary.

3.8.6.2 Internationally important assemblage of waterfowl

Description of the feature

In addition to supporting internationally important populations of individual birds, the Severn Estuary also qualifies under Article 4.2 as a wetland of international importance by regularly supporting over 20,000 waterfowl (Cranswick *et al.*, 1999, JNCC website). A peak count of over 100,000 waterfowl was recorded in the winter season of 1992-93 (Waters *et al.*, 1993). The wintering waterfowl assemblage (consisting of over 68,000 birds) includes all regularly occurring waterfowl.

Species that qualify as a listed component of the assemblage include all the birds covered by section 3.8.6.1 and species present in nationally important numbers.

These species are:

- **Dunlin** (migratory passage populations)
- **Redshank** (migratory passage populations)
- **Wigeon**
- **Teal**
- **Pintail**
- **Pochard**
- **Tufted duck**
- **Ringed plover**
- **Grey plover**
- **Curlew**
- **Whimbrel**
- **Spotted redshank**

The JNCC website also lists lapwing, mallard and shoveler as qualifying for future inclusion as part of this assemblage (Stroud, DA, et al., 2001. *The UK SPA network: its scope and content*. JNCC, Peterborough)

Key supporting habitats for the waterfowl assemblage

Since a number of species comprising the waterfowl assemblage are qualifying species in their own right, their habitat requirements are described in sections 3.4 and 3.5 above. This section therefore mainly deals with the habitat requirements of the other assemblage species which form part of the waterfowl assemblage.

Intertidal mudflats and sandflats - Many of the bird species found within the Severn Estuary are highly mobile, feeding and roosting in different areas, depending on food availability, weather and tides. They favour areas that have abundant prey species and unrestricted views for the early detection of predators. Some species of wader such as ringed plover and turnstone will feed on the rich invertebrate fauna associated with rotting seaweed occurring along undisturbed strandlines.

Pintail and Teal are widely distributed around the estuary with a notable concentration at the New Grounds. Pintail are also found at Peterstone/Rhymney. Pochard and tufted duck have a highly clumped daytime distribution mainly at New Grounds with most others at Peterstone and the mouth of the Rhymney. Large numbers of pochard move onto the estuary in periods of sustained cold weather. There is a large number of wintering ringed plover on the estuary and these numbers swell during the spring and autumn when there is a considerable passage of migrants through the Severn Estuary. There are major concentrations of curlew on the flats above the first Severn Bridge as well as Bridgwater Bay and the Welsh Grounds. The Severn Estuary is a particularly important staging post for whimbrel during autumn and spring passage periods where some birds feed on the mudflats. Spotted redshank are occasionally found on the Axe and Yeo estuaries.

Saltmarsh - Upper and lower saltmarsh provide important feeding and roosting areas for the internationally important assemblage of waterfowl throughout the estuary. The European white-fronted geese graze on a range of saltmarsh grasses and herbs. The birds feed on the saltmarsh and the transition to coastal grazing marsh in front of the sea defences in the upper estuary.

There are areas of well grazed saltmarsh with saltpans at the River Axe and in the upper reaches of the estuary, which are used by wigeon and other wildfowl. Pools in the higher marsh at Bridgwater Bay and in the saltmarsh above the Severn bridges are also attractive to waders and wildfowl, providing invertebrates and shelter. In the winter, ducks such as teal and pintail feed on seeds of saltmarsh plants such as *Salicornia* sp. and *Atriplex* sp. Probing waders such as curlew also feed on the saltmarsh.

The saltmarsh provides a safe haven for the feeding waders and wildfowl from the tides that flood the mudflats twice a day. Upper saltmarsh in particular makes ideal high water roost sites and there are main high tide roosts in some areas with little human disturbance where waders congregate from their feeding areas. Waders in particular, require very short vegetation to afford unrestricted views for the early detection of predators.

Hard substrate habitats (rocky shores) - The shingle and rocks in the estuary provide feeding areas for many wildfowl and waders and important roost sites at high tide. Many of the rocks are off shore and are therefore generally free from human disturbance. These include Gascar Rocks in the upper reaches, Blackstone Rocks at Clevedon and Stert Island in Bridgwater Bay. Whimbrel have major night roosts at Collister Pill and Stert Island and the Stert Island roost is the largest of its kind in Britain. Spotted redshank are also found around Stert Island. Some areas of hard substrate support eelgrass beds which provide a food source for grazing wildfowl species particularly European white-fronted goose and wigeon.

Freshwater coastal grazing marsh, improved grassland and open standing waters – these supporting habitats lie outside the European Marine Site boundary but within the SPA. They provide key areas for breeding, feeding and roosting for all the assemblage species particularly at high tide.

4. Conservation Objectives and Favourable Condition Tables For the European Marine Site

4.1 Conservation objectives for the Severn Estuary / Môr Hafren SAC

The protection and management of the SAC in accordance with Article 6 of the Habitats Directive, including in particular the consideration of plans and projects under Article 6(3) and 6(4), should be carried out in view of the conservation objectives in this section.

4.1.1 SAC interest feature 1: Estuaries

The conservation objective for the “estuaries” feature of the Severn Estuary SAC is to maintain the feature in favourable condition, as defined below:

The feature will be considered to be in favourable condition when, subject to natural processes¹, each of the following conditions are met

- i. the total extent of the estuary² is maintained;
- ii. the characteristic physical form (tidal prism/cross sectional area) and flow (tidal regime) of the estuary is maintained;
- iii. the characteristic range and relative proportions of sediment sizes and sediment budget³ within the site is maintained;
- iv. the extent, variety and spatial distribution⁴ of estuarine habitat communities⁵ within the site is maintained⁶;
- v. the extent, variety, spatial distribution⁴ and community composition of hard substrate habitats and their notable communities^{5(v)} is maintained;
- vi. the abundance of the notable estuarine species assemblages⁷ is maintained or increased;
- vii. the physico-chemical characteristics⁸ of the water column⁹ support the ecological objectives described above;
- viii. Toxic contaminants in water column⁹ and sediment are below levels which would pose a risk to the ecological objectives described above.
- ix. Airborne nutrient and contaminant loads are below levels which would pose a risk to the ecological objectives described above

The meaning of terms ¹⁻⁹ above is explained in **section 4.1.1.1**

Appendix 2 shows the extent of the “estuaries” feature within the Severn Estuary SAC European Marine Site.

4.1.1.1 Explanatory information for the “estuaries” conservation objective

¹ Natural processes in respect of the SAC

Each feature may be subject to both natural processes and human influence. Human influence on the interest features is acceptable provided that it is proved to be / can be established to be compatible with the achievement of the conditions set out under the definition of favourable condition for each interest feature. A failure to meet these conditions, which is entirely a result of natural process will not constitute unfavourable condition, but may trigger a review of the definition of favourable condition.

Dynamic physical process within estuaries can stem from variable weather conditions including one off storm events, and result in changes in wave exposure, riverine floods or tidal surges. These events can move large quantities of sediments and alter channel morphology, which affect current patterns and sediment transport within the estuary.

Where these processes occur without significant anthropogenic influence they fall under the umbrella of 'natural change'. Because estuaries are dynamic systems we can expect the amount and gross distribution of habitats to change in the future. In general estuarine communities and their supporting habitats are intrinsically more dynamic over short timescales when compared to other marine and terrestrial habitats. Some estuarine communities occur in cycles dependent upon the prevailing physical conditions. Features should not necessarily be considered in unfavourable condition caused by the short term disappearance of a particular community due to natural processes.

An important example of natural processes occurring over a longer timescale is that estuaries have a natural tendency to accumulate sediment, thereby changing their form from their original glacial morphology to a state where tidal energy is dissipated by sediment banks and other features such as saltmarsh. This, with other forces of natural change, will therefore cause the width and depth of the estuary to change over time, moving towards a state of dynamic equilibrium or 'most probable state'. As part of this process, the location and extent of saltmarshes and mudflats may change, provided there is capacity to accommodate readjustment. Future developments should aim to avoid impact on the future evolution of the system as where this process is constrained by human influence, the capacity of habitats to accommodate readjustment may be affected.

² Extent of the estuary

The landward limit of the estuary feature is the limit of highest astronomical tide or the site boundary where it is below highest astronomical tide, except where the landward limit is defined as straight lines across the mouths of rivers entering the estuary. The seaward limit is as shown in the map in Appendix 2. Where other Habitats Directive Annex I habitat types occur within the estuary, they also form part of the estuary feature. In addition, there are areas of the estuary which do not form part of other Annex I habitat types.

³ Sediment budget

The sediment budget refers to the total amount of sediment within the Severn Estuary taking into account the balance of sediment inputs and outputs.

⁴ Spatial distribution

Spatial distribution of estuarine communities refers to the macro spatial pattern in which communities are distributed around the estuary. This statement does not require micro-distribution of communities e.g. the exact mapped positions of specific communities to be maintained.

⁵ Estuarine habitat communities

***Note:** sections i – iv below list the habitat types which are also features of the Severn Estuary SAC in their own right as well as being 'sub-features' of the estuary feature. The detailed definitions of favourable conservation status for these features are provided under their respective conservation objectives.*

- i. Subtidal sandbanks (see section 4.1.2 for the conservation objective for this feature)
 - Sublittoral Sands and Muddy Sands
 - Sublittoral cohesive mud and sandy mud communities
- ii. Intertidal mudflats and sandflats (see section 4.1.3 for the conservation objective for this feature)
 - Intertidal gravel and clean sands
 - Intertidal muddy sands
 - Intertidal muds

- iii. Atlantic saltmeadows (see section 4.1.4 for the conservation objective for this feature)
 - Low – mid marsh communities
 - Mid – upper marsh communities
 - Transitional high marsh communities
 - Pioneer marsh communities
- iv. Reefs of *Sabellaria alveolata* (see section 4.1.5 for the conservation objective for this feature)
 - *Sabellaria alveolata* on variable salinity sublittoral mixed sediment (subtidal)
 - *Sabellaria alveolata* reefs on sand-abraded eulittoral rock (contiguous subtidal and intertidal)
- v. Hard substrate habitat notable communities
 - *Sabellaria alveolata* reefs on sand-abraded eulittoral rock (MLR.Sab.Salv)
 - *Hydroids, ephemeral seaweeds and Littorina littorea* in shallow eulittoral mixed substrata pools. (LR.RkpH)
 - *Balanus crenatus* and *Tubularia indivisa* on extremely tide-swept circalittoral rock. (ECR.BS.BalTub)
 - *Fucus serratus* and piddocks on lower eulittoral soft rock (MLR.Fser.Pid)
 - *Mytilus edulis* and piddocks on eulittoral firm clay (MLR.MytPid)
 - *Balanus crenatus*, *Halichondria panacea* and *Alcyonidium diaphanum* on extremely tide-swept sheltered circalittoral rock (ECR.BalHpan)
 - *Sertularia cupressina* and *Hydrallmania falcate* on tide-swept sublittoral cobbles or pebbles in coarse sand (IGS.ScupHyd).
 - *Corrallina officinalis* and coralline crusts in shallow eulittoral rockpools (LR.Rkp.Cor)
 - Eel grass (*Zostera*) beds
 - Peat and clay exposures
 - Any other notable hard substrata communities that may be identified.

⁶ Maintained

Since the late 1990s Natural England's condition assessment has identified that parts of the saltmarsh within the Severn Estuary appear to be exhibiting the effects of coastal squeeze. For this reason NE and CCW do not consider it sufficient simply to seek to maintain the existing saltmarsh resource, rather it is our advice that measures will be required which seek to recreate the approximate extent of saltmarsh habitat present within the estuary in 1995 (the year the Severn Estuary was first identified as a proposed SAC); whilst at all times working within the framework of seeking a sustainable estuary form. N.B. This is based upon a site specific consideration of the state of habitats within the Severn Estuary, and should not be extended to other sites on the basis of this advice.

⁷ Notable estuarine species assemblages

- i. Assemblage of fish species:
 - Migratory species
 - River and Sea Lamprey and Twaite shad (Annex 1 species) and Allis shad
 - Sea trout, salmon, eel,
 - Estuarine species
 - Species typically occurring and breeding in estuaries (Bird, 2008)
 - Marine species occurring in large numbers in estuaries (Bird, 2008)
 - Marine species
 - Predominantly marine species occurring infrequently in the Severn (Bird, 2008)
 - Freshwater species
 - Species typically occurring and breeding in freshwater and recorded within the Severn cSAC (Bird, 2008)

- ii Assemblage of waterfowl species (refer also sections 4.2 and 4.3 on the SPA and Ramsar Site):
 - Regularly occurring Annex 1 species - Bewicks' swan
 - Regularly occurring migratory species - European white-fronted goose, dunlin, redshank, shelduck, gadwall
 - Nationally important bird populations - wigeon, teal, pintail, pochard, tufted duck, ringed plover, grey plover, curlew, whimbrel and spotted redshank
- iii. Assemblage of vascular plant species:
 - Salt marsh species (refer to notes 5 and 6 in section 4.1.4.1 - explanatory information on the conservation objective for the Atlantic salt meadows feature)
 - Eel grass (*Zostera*) species.

⁸ **Physico-chemical characteristics**

These include nutrients, oxygen, turbidity, pH, temperature and salinity.

⁹ **Water column**

Water column should be read to include contributory water flows into the estuary including surface flows over mudflats and saltmarsh.

4.1.2 SAC interest feature 2: Subtidal sandbanks which are covered by sea water all the time (subtidal sandbanks)

The conservation objective for the “subtidal sandbanks” feature of the Severn Estuary SAC is to maintain the feature in favourable condition, as defined below:

The feature will be considered to be in favourable condition when, subject to natural processes¹, each of the following conditions are met:

- i. the total extent of the subtidal sandbanks² within the site is maintained;
- ii. the extent and distribution³ of the individual subtidal sandbank communities⁴ within the site is maintained;
- iii. the community composition⁵ of the subtidal sandbank feature within the site is maintained;
- iv. the variety and distribution³ of sediment types across the subtidal sandbank feature is maintained;
- v. the gross morphology (depth, distribution and profile) of the subtidal sandbank feature within the site is maintained.

The meaning of terms ¹⁻⁵ above is explained in **section 4.1.2.1**

Appendix 3 shows the extent of the “subtidal sandbanks” feature within the Severn Estuary SAC European Marine Site.

4.1.2.1 Explanatory information for the “subtidal sandbanks” conservation objective

¹ Natural processes in respect of the SAC

The meaning of ‘natural processes’ is explained in **section 4.1.1.1**

² Extent of subtidal sandbanks

The subtidal sandbanks in the Severn Estuary change their shape over time and many are ephemeral in nature, although some are relatively stable and long established. The extent of the Annex 1 habitat is considered to include both the actual sandbanks and their associated sediments. Areas of associated sediments have been defined by using the sediment environments of the Bristol Channel Marine Aggregates Resources and Constraints project, commissioned by the National Assembly for Wales (Posford Duvivier and ABP, 2000) Associated sediments have been defined as any area of of subtidal sand-sized sediment within the same sediment environment as a subtidal sandbank. Mobile sediments that form temporary sandbanks are considered to be associated sediments that should be retained in the system, but their location may change. Areas of holocene valley infill (relict sediment) are not mobile under present day estuarine conditions. Therefore, where Holocene infill is exposed, it is not considered to form part of the associated sediments. However, any mobile sand deposited over the infill does contribute to the associated sediments.

³ Distribution

Distribution of sandbank communities and sediments refers to the macro spatial pattern in which these are distributed around the estuary. This statement does not require micro-distribution of communities or sediments e.g. the exact mapped positions of specific communities or sediments to be maintained.

The sand banks of the Middle and Welsh Grounds are relatively permanent sandbank features in the Severn Estuary, along with other long established sandbank features at Cardiff Grounds and in Bridgwater Bay. The tops of these banks are intertidal, and the permanently submerged parts of the banks are considered to contribute to the subtidal sandbanks habitat.

There are other areas of subtidal sandbank habitat within the Estuary, again sometimes the top of the bank may be exposed at low tide, with the submerged sections contributing to the subtidal sandbanks habitat. These banks are more ephemeral in nature, but are still considered part of the feature, and reflect the dynamic nature of the Severn Estuary. The areas where ephemeral subtidal sandbanks are known to occur include areas offshore from Avonmouth and at English Grounds (near Clevedon).

The macro-scale distribution of the subtidal sandbanks should be maintained, and there should be continued presence of ephemeral subtidal sandbanks in the Estuary.

⁴ Subtidal sandbank communities

There are two groups of communities comprising the ‘sub-features’ of the subtidal sandbanks feature:

- Sublittoral Sands and Muddy Sands:
 - i. Infralittoral mobile sand in variable salinity (estuaries)
 - ii. Infralittoral mobile clean sand with sparse fauna
 - iii. *Nephtys cirrosa* and *Macoma balthica* in variable salinity infralittoral mobile sand
 - iv. *Neomysis integer* and *Gammarus* spp. in fluctuating low salinity infralittoral mobile sand
- Sublittoral cohesive mud and sandy mud communities:
 - i. *Capitella capitata* in enriched sublittoral muddy sediments
 - ii. *Nephtys hombergii* and *Tubificoides* spp. in variable salinity infralittoral soft mud
 - iii. *Capitella capitata* and *Tubificoides* spp. in reduced salinity infralittoral muddy sediment*
 - iv. *Nephtys hombergii* and *Macoma balthica* in infralittoral sandy mud*

(* these records have a lower degree of confidence than the other communities listed, i.e. the biotope assessor was uncertain regarding precisely which biotope should be recorded).

⁵ Community composition

Species typical of the subtidal sandbank communities:

Aricidea minuta
Capitella capitata
Diastylis rathkei typica
Eurydice pulchra
Gammarus salinus
Harpinia pectinata
Mediomastus fragilis
Nephtys cirrosa
Nephtys hombergii
Oligochaeta
Pygospio elegans
Pontocrates arenarius
Pseudocuma longicornis
Retusa obtusa
Tubificoides amplivasatus

4.1.3 SAC interest feature 3 : Mudflats and sandflats not covered by seawater at low tide (mudflats and sandflats)

The conservation objective for “mudflats and sandflats” feature of the Severn Estuary SAC is to maintain the feature in favourable condition, as defined below:

The feature will be considered to be in favourable condition when, subject to natural processes¹, each of the following conditions are met:

- i. The total extent of the mudflats and sandflats feature² is maintained;
- ii. the variety and extent of individual mudflats and sandflats communities³ within the site is maintained;
- iii. the distribution⁴ of individual mudflats and sandflats communities³ within the site is maintained;
- iv. the community composition⁵ of the mudflats and sandflats feature within the site is maintained;
- v. the topography of the intertidal flats and the morphology (dynamic processes of sediment movement and channel migration across the flats) are maintained.

The meaning of terms ¹⁻⁵ above is explained in **section 4.1.3.1**.

Appendix 4 shows the extent of the “mudflats and sandflats” feature within the Severn Estuary SAC European Marine Site.

4.1.3.1 Explanatory information for the “mudflats and sandflats” conservation objective

¹ Natural processes in respect of the SAC

The meaning of ‘natural processes’ is explained in **section 4.1.1.1**.

²Extent of the intertidal mudflats and sandflats

The extent of the feature is defined using intertidal Phase 1 survey information, which gives the seaward limit of the feature as the low water mark of spring tides (MLWS) because that is in practice the lower limit to which Phase 1 survey is possible. The feature does not include other intertidal habitats which are not mudflats and sandflats, such as intertidal reefs and rocky shores. This is the basis on which the feature is shown in the map in Figure 4, the total extent being 20,271 ha. However in addition there will be some areas of intertidal mudflat and sandflat seaward of MLWS and down to Lowest Astronomical Tide, which is the absolute seaward limit of this habitat type.

³Mudflat and sandflat communities

There are three groups of communities comprising the “sub-features” of the “Mudflats and sandflats not covered by seawater at low tide” feature:

- Intertidal gravel and clean sand communities

- i. Barren coarse sand shores; **LGS.S.BarSnd**
- ii. Burrowing amphipods and *Eurydice pulchra* in well drained clean sand shores; **LGS.S.AEur**
- iii. Burrowing amphipods and polychaetes in clean sand shores. **LGS.S.AP**
- iv. Talitrid amphipods in decomposing seaweed on the strandline **LGS.S.Tal**
- v. Dense *Lanice conchilega* in tide-swept lower shore sand **LGS.S.Lan**
- vi. Barren shingle or gravel shores **LGS.Sh.BarSh**

- Intertidal muddy sand communities :

- i. Polychaetes and *Cerastoderma edule* in fine sand or muddy sand shores **LMS.MS.PCer**
- ii. *Bathyporeia pilosa* and *Corophium* spp. in upper shore slightly muddy fine sand shores **LMS.MS.BatCor**
- iii. *Macoma balthica* and *Arenicola marina* in muddy sand shores. **LMS.MS.MacAre**

- Intertidal mud communities:

- i. *Hediste diversicolor* and *Macoma balthica* in sandy mud shores: **LMU.SMu.HedMac**
- ii. *Hediste diversicolor*, *Macoma balthica* and *Arenicola marina* in muddy sand or sandy mud shores **LMU.SMu.HedMacAre**
- iii. *Hediste diversicolor* and *Scrobicularia plana* in reduced salinity mud shores **LMU.Mu.HedScr**
- iv. *Hediste diversicolor* and oligochaetes in low salinity mud shores **LMU.Mu.HedOl**
- v. *Hediste diversicolor* and *Streblospio shrubsolii* in sandy mud or soft mud shores **LMU.Mu Hed Str**

Appendix 4a shows the extent of the “mudflats and sandflats” subfeatures within the Severn Estuary SAC European Marine Site.

⁴ Distribution

The distribution of mudflats and sandflats communities refers to the macro spatial pattern in which these communities are distributed around the estuary. This statement does not require micro-distribution of communities e.g. the exact mapped positions of specific communities to be maintained.

⁵ Community composition

Species typical of the mudflat and sandflat communities:

Aphelocheata marioni
Arenicola marina
Bathyporeia pelagica
Corophium volutator
Enchytraeidae
Eurydice pulchra
Hediste diversicolor
Hydrobia ulvae
Macoma balthica
Nephtys cirrosa
Nephtys hombergii
Oligochaeta indet.
Pygospio elegans
Scoloplos armiger
Scrobicularia plana
Streblospio shrubsolii
Tubificoides benedii

4.1.4 SAC interest feature 4: Atlantic salt meadow

The conservation objective for the “Atlantic salt meadow” feature of the Severn Estuary SAC is to maintain the feature in favourable condition, as defined below:

The feature will be considered to be in favourable condition when, subject to natural processes¹, each of the following conditions are met:

- i. the total extent of Atlantic salt meadow and associated transitional vegetation communities² within the site is maintained³;
- ii. the extent and distribution⁴ of the individual Atlantic salt meadow and associated transitional vegetation communities² within the site is maintained;
- iii. the zonation of Atlantic salt meadow vegetation communities and their associated transitions² to other estuary habitats is maintained;
- iv. the relative abundance of the typical species⁵ of the Atlantic salt meadow and associated transitional vegetation communities² is maintained;
- v. the abundance of the notable species⁶ of the Atlantic salt meadow and associated transitional vegetation communities² is maintained.
- vi. the structural variation of the salt marsh sward (resulting from grazing) is maintained within limits sufficient to satisfy the requirements of conditions iv and v above and the requirements of the Ramsar and SPA features⁷
- vii. the characteristic stepped morphology of the salt marshes and associated creeks, pills, drainage ditches and pans, and the estuarine processes that enable their development, is maintained.
- viii. Any areas of *Spartina anglica* salt marsh (SM6) are capable of developing naturally into other saltmarsh communities.⁸

The meaning of terms ¹⁻⁸ above is explained in **section 4.1.4.1**.

Appendix 5 shows the extent of Atlantic salt meadow and its associated transitional vegetation communities within the Severn Estuary SAC European Marine Site.

4.1.4.1 Explanatory information for the “Atlantic salt meadow” conservation objective

¹ Natural processes in respect of the SAC

The meaning of ‘natural processes’ is explained in **section 4.1.1.1**.

² Atlantic salt meadow and associated transitional vegetation communities

The vegetation communities comprising the Atlantic Salt Meadow feature can be grouped into four ‘sub-features’, namely:

- (a) low to mid marsh communities
- (b) mid to upper marsh communities
- (c) transitional high marsh communities
- (d) pioneer saltmarsh communities

The communities in each of these sub-features are listed below.

Sub-features (a) and (b) contain the National Vegetation Classification (NVC) communities which fall within the definition of Atlantic Salt Meadow in the EU Interpretation Manual. The extent of these two sub-features within the SAC is currently estimated at 656 ha. The communities in (c) and (d) do not fall within the Atlantic Salt Meadow definition, but are considered to be important components of this feature as they represent its landward and seaward transitions to other habitat types, namely non-saline vegetation and pioneer salt marsh respectively. Atlantic salt meadow is a naturally dynamic habitat and these transitional communities are considered to be an integral part of the Atlantic Salt Meadow feature and essential elements of its structure and function. The total extent of all four of the above sub-features in the SAC is estimated to be 1400 ha, distributed in the SAC as shown in Appendix 5a.

(a) Low to mid marsh communities:

- i. Transitional low saltmarsh with *Puccinellia maritima*, annual *Salicornia* sp. and *Suaeda maritima* SM10
- ii. *Aster tripolium* (rayed) saltmarsh SM12
- iii. *Puccinellia maritima* saltmarsh SM13
 - o *Puccinellia maritima* sub-community SM13a
 - o *Glaux maritima* sub-community SM13b
 - o *Limonium vulgare* - *Armeria maritima* sub-community SM13c
 - o *Plantago maritima* - *Armeria maritima* sub-community SM13d
 - o *Plantago maritima*-*Triglochin maritima* sub-community SM13x (provisional)
 - o *Spartina anglica* sub-community SM13y (provisional)
- iv. *Atriplex portulacoides* saltmarsh SM14
 - o *Atriplex portulacoides* sub-community SM14a
- v. *Juncus maritimus* - *Triglochin maritima* saltmarsh SM15

(b) Mid to upper marsh communities:

- i. *Festuca rubra* salt-marsh SM16
 - o *Puccinellia maritima* sub-community SM16a
 - o *Juncus gerardii* sub-community SM16b
 - o *Glaux maritima* sub-community SM16c
 - o *Festuca rubra* sub-community SM16d
 - o *Leontodon autumnalis* sub-community SM16e
 - o *Aster tripolium* sub-community SM16x (provisional)
- ii. *Artemisia maritima* saltmarsh SM17
- iii. *Juncus maritimus* salt-marsh SM18
 - o *Festuca arundinacea* sub-community SM18c

(c) Transitional high marsh communities:

- i. *Spergularia marina* - *Puccinellia distans* saltmarsh SM23
 - ii. *Elytrigia atherica* saltmarsh SM24
 - iii. *Elytrigia repens* saltmarsh SM28
 - iv. *Festuca rubra* - *Agrostis stolonifera* - *Potentilla anserina* inundation grassland MG11
 - v. *Festuca arundinacea* coarse grassland MG12
 - vi. *Agrostis stolonifera* - *Alopecurus geniculatus* inundation grassland MG13
 - vii. *Phragmites australis* reedbed S4
 - o *Phragmites australis* sub-community S4a
 - xiii. *Bolboschoenus maritimus* swamp S21
 - o *B. maritimus* sub-community S21a
- Agrostis stolonifera* sub-community S21c

(d) Pioneer saltmarsh communities:

- i. *Spartina anglica* saltmarsh SM6
- ii. Annual *Salicornia* saltmarsh SM8
- iii. *Suaeda maritima* saltmarsh SM9

³ Maintained

Since the late 1990s Natural England's condition assessment has identified that parts of the saltmarsh within the Severn Estuary appear to be exhibiting the effects of coastal squeeze. For this reason NE and CCW do not consider it sufficient simply to seek to maintain the existing saltmarsh resource, rather it is our advice that measures will be required which seek to recreate the approximate extent of saltmarsh habitat present within the estuary in 1995 (the year the Severn Estuary was first identified as a proposed SAC); whilst at all times working within the framework of seeking a sustainable estuary form. N.B. This is based upon a site specific consideration of the state of habitats within the Severn Estuary, and should not be extended to other sites on the basis of this advice.

⁴ Distribution

The distribution Atlantic salt meadow communities refers to the macro spatial pattern in which these are distributed around the estuary. This statement does not require micro-distribution of communities e.g. the exact mapped positions of specific communities to be maintained.

⁵ Typical species of the Atlantic salt meadow

Festuca arundinacea
Festuca rubra
Juncus gerardii
Triglochin maritimum
Carex extensa
Agrostis stolonifera
Juncus maritimus
Oenanthe lachenalii
Puccinellia maritima,
Salicornia spp.
Suaeda maritima
Aster tripolium
Glaux maritima
Plantago maritima
Armeria maritima
Elytrigia atherica
Atriplex prostrata
Phragmites australis
Spartina anglica
Spergularia media
Puccinellia distans
Cochlearia anglica
Cochlearia officinalis
Limonium vulgare
Atriplex portulacoides
Seriphidium maritimum
Plantago coronopus
Beta vulgaris maritima

⁶ Notable Atlantic salt meadow vegetation species

Alopecurus bulbosus
Althaea officinalis
Bupleurum tenuissimum
Hordeum marinum
Puccinellia rupestris
Trifolium squamosum
Lepidium latifolium

Allium oleraceum

Petroselinum segetum

⁷ **Severn Estuary SPA and Severn Estuary Ramsar Site Conservation Objectives**

Refer to sections 4.2 and 4.3 of this document

⁸ ***Spartina anglica* SM6**

Spartina in the Severn is considered to be an invasive species and these conservation objectives do not seek the maintenance of the extent or condition of this habitat type. However, SM6 is considered to be a transitional salt marsh community and the conservation objectives seek to protect the ability of areas of *Spartina* to develop into other Atlantic Salt Meadow or transitional communities.

4.1.5 SAC interest feature 5 : Reefs

The conservation objective for the “reefs” feature of the Severn Estuary SAC is to maintain the feature in a favourable condition, as defined below:

The feature will be considered to be in favourable condition when, subject to natural processes¹, each of the following conditions are met:

- i. the total extent and distribution² of *Sabellaria* reef³ is maintained;
- ii. the community composition⁴ of the *Sabellaria* reef is maintained;
- iii. the full range of different age structures of *Sabellaria* reef are present;
- iv. the physical⁵ and ecological processes⁶ necessary to support *Sabellaria* reef are maintained.

The meaning of terms ¹⁻⁶ above is explained in **section 4.1.5.1** below.

Appendix 6 shows the extent of the “reef” feature within the Severn Estuary SAC European Marine Site.

4.1.5.1 Explanatory information for the “reefs” conservation objective

¹ Natural processes in respect of the SAC

The meaning of ‘natural processes’ is explained in section **4.1.1.1**

² Distribution

The distribution of reefs refers to the macro spatial pattern in which the reefs are distributed around the estuary. This statement does not require micro-distribution of the reefs e.g. the exact mapped positions of specific reefs to be maintained.

³ *Sabellaria* reef

Little is known about the nature of the *Sabellaria alveolata* reef in the Severn Estuary, especially in the subtidal. However, at other sites *S. alveolata* is known to have a very variable recruitment and the cover in any one area may vary greatly over a number of years. *S. alveolata* reefs also cycle through different phases, from newly settled worms through vigorous fast growing reef to older hummocks. It is likely that subtidal *S. alveolata* reef in the Severn Estuary will exhibit reduced growth forms (lower elevation) in comparison to the intertidal reef habitat. The easiest of these phases to identify is the fast growing reef and for the purposes of these conservation objectives this is defined as a dense aggregation of worms (over 1000 per m², as a rough guide), generally forming a thick (2 cm or more) crust of tubes. The area covered by the habitat would generally exceed 25 m² although there could be patchiness within this area. The other phases of growth are also important and are encompassed in point iii of the objective.

The *S. alveolata* reef biotopes recorded in the Severn Estuary are SS.SBR.PoR.SalvMx *Sabellaria alveolata* on variable salinity sublittoral mixed sediment and LS.LBR.Sab.Salv *Sabellaria alveolata* reefs on sand-abraded eulittoral rock.

⁴ Community composition

Species associated with dense aggregations of *Sabellaria alveolata* in the Severn estuary:

Subtidal

Sabellaria alveolata
Eulalia tripunctata

Mediomastus fragilis
Typosyllis armillaris
Ampharete grubei
Harpinia pectinata
Melinna cristata
Pygospio elegans
Scoloplos armiger
Nemertea
Nucula nitidosa
Nucula nucleus
Tubificoides amplivasatus
Golfingia vulgaris vulgaris
Gammarus salinus
Tubificoides
Arenicola marina
Sphenia binghami
Eumida sanguinea
Nephtys hombergii
Autolytus prolifera
Harmothoe impar
Nematoda
Polycirrus
Dodecaceria concharum
Harmothoe
Syllidae
Enchytraeidae

Intertidal

Sabellaria alveolata,
Actinia equina
Cancer pagurus
Elminius modestus
Littorina saxatilis
L.littorea
L.obtusata
Pholas dactylus
Pomatocerus lamarcki
Porcellana platycheles
Semibalanus balanoides
Halichondrea sp
Corallina officinalis
Enteromorpha sp.
Fucus serratus
Fucus vesiculosus
Pelvetia canaliculata
Porphyra sp
Ulva sp

⁵Physical processes

- abundance of suitable coarse sediments to support reef growth (tube building)
- the availability of suitable substrates where *Sabellaria* has been known to occur in the past

⁶Ecological Processes

- supply of *Sabellaria* larvae (within the water column)
- abundance of food (suspended detritus material) within the water column to support feeding

4.1.6 SAC interest feature 6 : River lamprey *Lampetra fluviatilis*

The conservation objective for the river lamprey *Lampetra fluviatilis* feature of the Severn Estuary SAC is to maintain the feature in a favourable condition, as defined below:

The feature will be considered to be in favourable condition when, subject to natural processes¹, each of the following conditions are met:

- i. the migratory passage of both adult and juvenile river lamprey through the Severn Estuary between the Bristol Channel and any of their spawning rivers is not obstructed or impeded by physical barriers, changes in flows, or poor water quality;
- ii. the size of the river lamprey population in the Severn Estuary and the rivers which drain into it, is at least maintained and is at a level that is sustainable in the long term;
- iii. the abundance of prey species² forming the river lamprey's food resource within the estuary, is maintained.
- iv. Toxic contaminants in the water column³ and sediment are below levels which would pose a risk to the ecological objectives described above.

The meaning of terms ¹⁻³ above is explained in **section 4.1.6.1**.

Note : The river lamprey population of the Severn depends on habitat in the adjacent River Usk SAC, River Wye SAC and River Severn. The habitats in these rivers, including spawning and nursery areas, are essential for the fulfilment of the species' lifecycle and therefore the Severn Estuary river lamprey feature can only be in favourable condition if the conservation objectives pertaining to the River Usk SAC and River Wye SAC river lamprey feature are also met in full and there is a continued recorded presence of this species in the River Severn.

4.1.6.1 Explanatory information for the river lamprey *Lampetra fluviatilis* conservation objective

¹ Natural processes in respect of the SAC fish features

River lamprey population:

The size of the population is subject to non anthropogenic factors relating to natural fluctuations of external factors such as food / host availability in the Bristol Channel and more widely and breeding success in the River Severn and other rivers draining into the Severn Estuary.

Supporting habitats

The general meaning of 'natural processes' with respect to the supporting habitats of river lamprey within the estuary is explained in **section 4.1.1.1**

² Prey species

Sea trout *Salmo trutta*, shad *Alosa fallax/Alosa alosa*, herring *Clupea harengus*, sprat *Sprattus sprattus*, flounder *Platichthys flesus* and small gadoids such as whiting *Merlangius merlangus* and pout *Trisopterus luscus* are all potential prey species for the river lamprey found within the Severn Estuary (Bird 2008).

³Water column

Water column should be read to include contributory water flows into the estuary including surface flows over mudflats and saltmarsh.

4.1.7 SAC interest feature 7: The conservation objective for sea lamprey *Petromyzon marinus*

The conservation objective for the sea lamprey *Petromyzon marinus* feature of the Severn Estuary SAC is to maintain the feature in a favourable condition, as defined below:

The feature will be considered to be in favourable condition when, subject to natural processes¹, each of the following conditions are met:

- i. the migratory passage of both adult and juvenile sea lamprey through the Severn Estuary between the Bristol Channel and any of their spawning rivers is not obstructed or impeded by physical barriers, changes in flows, or poor water quality;
- ii. the size of the sea lamprey population in the Severn Estuary and the rivers which drain into it, is at least maintained as is at a level that is sustainable in the long term;
- iii. the abundance of prey species² forming the sea lamprey's food resource within the estuary, is maintained.
- vi. Toxic contaminants in the water column³ and sediment are below levels which would pose a risk to the ecological objectives described above.

The meaning of terms ¹⁻³ above is explained in **section 4.1.7.1**.

Note : The sea lamprey population of the Severn depends on habitat in the adjacent River Usk SAC, River Wye SAC and River Severn. The habitats in these rivers, including spawning and nursery areas, are essential for the fulfilment of the species' lifecycle and therefore the Severn Estuary sea lamprey feature can only be in favourable condition if the conservation objectives pertaining to the River Usk SAC and River Wye SAC sea lamprey shad feature are also met in full and there is a continued recorded presence of this species in the River Severn.

4.1.7.1 Explanatory information for the sea lamprey *Petromyzon marinus* conservation objective

¹ Natural processes in respect of the SAC fish features

Sea lamprey population:

The size of the population is subject to non anthropogenic factors relating to natural fluctuations of external factors such as food / host availability in the Bristol Channel and more widely and breeding success in the River Severn and other rivers draining into the Severn Estuary.

Supporting habitats:

The general meaning of 'natural processes' with respect to the supporting habitats of sea lamprey within the estuary is explained in **section 4.1.1.1**.

² Prey species

Eel *Anguilla anguilla*, cod *Gadus morhua*, and haddock *Melanogrammus aeglefinus* are all potential prey species for the sea lamprey found within the Severn Estuary (Bird 2008)

³ Water column

Water column should be read to include contributory water flows into the estuary including surface flows over mudflats and saltmarsh.

4.1.8 SAC interest feature 8: The conservation objective for twaite shad *Alosa fallax*

The conservation objective for the twaite Shad *Alosa fallax* feature of the Severn Estuary SAC is to maintain the feature in a favourable condition, as defined below:

The feature will be considered to be in favourable condition when, subject to natural processes¹, each of the following conditions are met:

- i. the migratory passage of both adult and juvenile twaite shad through the Severn Estuary between the Bristol Channel and their spawning rivers is not obstructed or impeded by physical barriers, changes in flows or poor water quality;
- ii. the size of the twaite shad population within the Severn Estuary and the rivers draining into it is at least maintained and is at a level that is sustainable in the long term.
- iii. the abundance of prey species² forming the twaite shad's food resource within the estuary, in particular at the salt wedge³, is maintained.
- iv. Toxic contaminants in the water column⁴ and sediment are below levels which would pose a risk to the ecological objectives described above.

The meaning of terms¹⁻⁴ above is explained in **section 4.1.8.1**.

Note : The twaite shad population of the Severn depends on habitat in the adjacent River Usk SAC, River Wye SAC and River Severn. The habitats in these rivers, including spawning and nursery areas, are essential for the fulfilment of the species' lifecycle and therefore the Severn Estuary twaite shad feature can only be in favourable condition if the conservation objectives pertaining to the River Usk SAC and River Wye SAC twaite shad feature are also met in full and there is a continued recorded presence of this species in the River Severn.

4.1.8.1 Explanatory information for the Twaite shad *Alosa fallax* conservation objective

¹ Natural processes in respect of the SAC fish features

Twaite shad population:

The size of the population is subject to non anthropogenic factors relating to natural fluctuations of external factors such as food availability in the Bristol Channel and more widely and breeding success in the River Severn and other rivers draining into the Severn Estuary.

Supporting habitats:

The general meaning of 'natural processes' with respect to the supporting habitats of twaite shad within the estuary is explained in **section 4.1.1.1**.

² Prey species

Small crustaceans, especially mysids and copepods, small fish, especially sprats and anchovies, and fish eggs (Maitland, P.S. & Hatton-Ellis 2003).

³ Salt wedge

This the area within the estuary where fresh and saline water meet and where the abundance of prey species is particularly important to the twaite shad population. The actual position varies according to the state of the tide and volume of freshwater input to the estuary.

⁴ **Water column**

Water column should be read to include contributory water flows into the estuary including surface flows over mudflats and saltmarsh.

4.1.9 Favourable Condition Tables for the SAC interest features of the Severn Estuary European Marine Site

Background information on the role of favourable condition tables and the information provided in each column is provided in Section 1.8 of this document, and a concise glossary of terms used is provided in Section 7.

The favourable condition table is intended to supplement the conservation objectives, including with respect to the management of established and ongoing activities, future requirements of monitoring and reporting on the condition of the features of the site and, together with the conservation objectives, informs the scope and nature of any appropriate assessment that may be needed. The table **does not by itself** provide a comprehensive basis on which to assess plans and projects as required under the Habitats Regulations. It should be noted that appropriate assessments are a separate activity to condition monitoring, requiring consideration of issues specific to individual plans or projects.

These tables set out all the attributes that **may** be used to monitor the condition of the features of the SAC. Where possible we will seek available information from others which can inform our assessment process.

It will be possible to monitor many of the attributes at the same time or during the same survey. The frequency of sampling for many attributes may need to be greater during the first reporting cycle in order to characterise the site and establish the baseline. Where relevant, abbreviations of National Vegetation Classification (NVC) codes are used for simplicity (Rodwell, 2000).

Comprising :

Table 8 – Favourable condition table for the “estuaries” feature of the Severn Estuary SAC and (in part) for the Ramsar Site (refer to section 4.3.1)

Table 9 – Favourable condition table for the “subtidal sandbanks” feature of the Severn Estuary SAC

Table 10 – Favourable condition table for the “intertidal mudflats and sandflats” feature of the Severn Estuary SAC

Table 11 – Favourable condition table for the “Atlantic salt meadows” feature of the Severn Estuary SAC

Table 12 – Favourable condition table for the “reefs” feature of the Severn Estuary SAC

Table 13 – Favourable condition table for the “river lamprey” and “sea lamprey” features of the Severn Estuary SAC

Table 14 – Favourable condition table for the “twait shad” feature of the Severn Estuary SAC

Table 8 – Favourable condition table for the “estuaries” feature of the Severn Estuary SAC and (in part) for the Ramsar Site (refer to section 4.3.1)

Ref	SAC Interest Feature	Sub-feature	Attribute	Measure	Target	Comments
A1	SAC interest feature 1: Estuaries		Extent <i>(Total extent of the estuaries feature - section 4.1.1.i of the conservation objectives)</i>	Total area (ha) of estuary feature	No decrease in extent due to man induced changes from the established baseline <i>The baseline is the extent of all areas subject to tidal influence within the boundary of the designation of the pSAC in 2000 - see also map in Appendix 2</i>	Extent is an attribute on which reporting is required by the Habitats Directive.
A2		All sub-features	Morphology <i>(Characteristic physical form and flow - section 4.1.1.ii of the conservation objectives)</i>	Intra and inter-estuarine Tidal Prism/Cross Section ratio (TP/CS ratio) measured during the reporting cycle using remote sensing (frequency to be determined).	The intra- and inter- estuarine TP/CS relationship should not deviate significantly from an established baseline subject to natural processes (* includes recognition of fixed hard geology formations) <i>Baseline to be established :- Data to be used is Hydrological Office bathymetry data (intertidal and subtidal) and Environment Agency LIDAR survey</i>	TP = Tidal Prism = total volume of water crossing a given cross section during the flood tide (m ³). CS = Area of a given cross section at high water springs (m ²). The relationship between TP & CS provides a measure of the way the estuary has adjusted to tidal energy. Substantial departures from this characteristic relationship (determined on a regional basis) may indicate the influence of anthropogenic factors and this would trigger more detailed evaluation of potential problems. The identification of a suitable baseline for TP/CS relationship will need to take account of the highly dynamic nature of the Severn and potential impacts of natural processes (including sea level rise) in altering the profile of the estuary – with a view to maintaining or promoting the movement of the estuary towards “dynamic equilibrium”. *The hard geology formations (headlands, cliffs and rock platforms) have a major role in influencing the characteristic physical form and flow of the estuary (many are protected in their own right as geological SSSI).

Ref	SAC Interest Feature	Sub-feature	Attribute	Measure	Target	Comments
A3	SAC interest feature 1: Estuaries		Tidal regime and flows (saline water and freshwater contributions) <i>(characteristic physical form and flow - section 4.1.1.ii of the conservation objectives)</i>	Tidal range, measured from tide gauges at specified locations, and flows measured from current estuary and river meters . Locations and frequency to be determined	No decrease in tidal range subject to natural processes. Tidal currents should not deviate significantly from an established baseline subject to natural processes Riverine flows (Rivers Wye, Usk and Severn) and estuarine flows must be sufficient to ensure Water Framework Directive target of Good Ecological Status (GES) is met. <i>Baseline to be established :- Data to be used is existing tide gauge and current meter data from EA ca 2000, and agreed WFD monitoring measures.</i>	

Ref	SAC Interest Feature	Sub-feature	Attribute	Measure	Target	Comments
A4			Sediment budget <i>(characteristic range and relative proportions of sediment sizes and sediment budget - section 4.1.1.iii of the conservation objectives)</i>	Evaluation of the sediment fluxes, sources and sinks, using a variety of measures including bathymetry, suspended sediment concentrations, fluvial and marine influx/efflux, man-made changes (e.g. navigational dredging/marine minerals extraction), cliff erosion etc)	No decrease in sediment budget from the established baseline <i>Baseline to be established :- Data to be used is Severn Estuary Coastal Habitat Management Plan (CHaMP) Part F- Sediment Budget Analysis</i>	A sediment budget is a balance of the sediment volume entering and exiting a particular section of the coast or an estuary. Sediment budget analysis consists of the evaluation of sediment fluxes, sources and sinks from different processes that give rise to additions and subtractions within a control volume (e.g. a section of coast or an estuary) in order to gain a better understanding of the estuary system. An estuary provides a readily defined control volume, where point sources and sinks exist in the form of rivers, other terrestrial outfalls and the open sea. Line sources and sinks may be defined in terms of erosion from cliffs and transfers to or from saltmarshes, wetlands or other intertidal areas. The subtidal beds also needs consideration as an important source/sink as does material stored in suspension within the volume of water that moves back and forth under tidal action within the estuary. Identification and quantification of all the mechanisms giving rise to sediment transfers can be difficult, and for the most part are approximate estimates of sediment exchange between sources and sinks. Reference ; ABPmer and HR Wallingford (2007).
A5	SAC interest feature 1: Estuaries		Sediment size, range and distribution <i>(characteristic range and proportions of sediment sizes and sediment budget - section 4.1.1.iii of the conservation objectives)</i>	Sediment size distribution characterised and measured by particle size analysis (PSA) at a series of locations across the estuary during the reporting cycle (locations and frequency to be determined)	Sediment size distribution should not deviate from an established baseline. <i>Baseline to be established :- Data to be used is BGS seabed sediment data and other relevant datasets ?</i>	PSA measures parameters including percentage sand/silt/gravel, mean and median grain size and sorting co-efficient, used to characterise sediment type. Sediment character is key to the structure of the features and reflects the physical processes acting on it – it may vary across the estuary and can be used to indicate the spatial distribution of sediment types reflecting the stability of the features and the processes supporting it..
A6		Subtidal sandbanks	Extent, variety and spatial distribution of estuarine habitat communities <i>(section 4.1.1.iv of the conservation objectives)</i>	<i>For information on the attributes of the subtidal sandbank communities sub-feature see the sections of this table which relate to the subtidal sandbanks which are covered by seawater all the time feature, see Table 9</i>		

Ref	SAC Interest Feature	Sub-feature	Attribute	Measure	Target	Comments
A7		Intertidal mudflat and sandflat communities	Extent, variety and spatial distribution of estuarine habitat communities (section 4.1.1.iv of the conservation objectives)			For information on the attributes of the intertidal mudflat & sandflat communities sub-feature see the sections of this table which relate to the intertidal mudflats and sandflats not covered by seawater at low tide feature, see Table 10
A8		Atlantic salt meadow (and associated transition habitats)	Extent, variety and spatial distribution of estuarine habitat communities (section 4.1.1.iv of the conservation objectives)			For information on the attributes of the Atlantic salt meadow communities sub-feature see the sections of this table which relate to Atlantic salt meadow feature, see Table 11
A9		Reefs of <i>Sabellaria alveolata</i>	Extent, variety and spatial distribution of estuarine habitat communities (section 4.1.1.iv of the conservation objectives)			For information on the attributes of the Reef sub-feature see the sections of this table which relate to the Reef feature, see Table 12

Ref	SAC Interest Feature	Sub-feature	Attribute	Measure	Target	Comments
A10	SAC interest feature 1: Estuaries	Hard substrate habitats and their notable communities	Extent & variety <i>(extent, variety, spatial distribution and community composition of hard substrate habitats and their notable communities - section 4.1.1.v of the conservation objectives)</i>	Area (ha) and range of types of hard substrate habitats and their notable communities, measured periodically during the reporting cycle along sampling transects or grids (frequency to be determined).	No decrease in extent or range of types of hard substrate habitats and their notable communities from the established baseline subject to natural processes. <i>Baseline is the CCW and English Nature Intertidal Biotope Surveys 2006.</i>	Loss of hard substrate habitats and their notable communities is likely to be detrimental to the structure of the interest feature, e.g. associated with a change in estuary processes and may indicate long term changes in the physical conditions of the estuaries interest feature. Notable communities of the Severn Estuary comprise the following • <i>Sabellaria alveolata</i> reefs on sand-abraded eulittoral rock (MLR.Sab.Salv) • <i>Hydroids, ephemeral seaweeds and Littorina littorea</i> in shallow eulittoral mixed substrata pools. (LR.RkpH) • <i>Balanus crenatus</i> and <i>Tubularia indivisa</i> on extremely tide-swept circalittoral rock.(ECR.BS.BalTub) • <i>Fucus serratus</i> and piddocks on lower eulittoral soft rock (MLR.Fser.Pid) • <i>Mytilus edulis</i> and piddocks on eulittoral firm clay (MLR.MytPid) • <i>Balanus crenatus</i>, <i>Halichondrea panicea</i> and <i>Alcyonidium diaphanum</i> on extremely tide-swept sheltered circalittoral rock (ECR.BalHpan) • <i>Sertularia cupressina</i> and <i>Hydrallmania falcate</i> on tide-swept sublittoral cobbles or pebbles in coarse sand (IGS.ScupHyd). • <i>Corralina officinalis</i> and coralline crusts in shallow eulittoral rockpools (LR.rkp.Cor) • Eel grass (<i>Zostera</i>) beds • Any other notable hard substrata communities that may be identified.
A11			Spatial distribution <i>(extent, variety, spatial distribution and community composition of notable communities - section 4.1.1.v of the conservation objectives)</i>	Spatial distribution of notable communities measured periodically during the reporting cycle using a combination of remote sensing and ground truthing using GPS (frequency to be determined).	Macroscale distribution of notable communities should not deviate significantly from the established baselines, subject to natural processes. <i>Baseline is the CCW and English Nature Intertidal Biotope Surveys 2006.</i>	Changes in the variety or distribution of notable estuarine communities may indicate long term changes in the physical conditions of the estuary interest feature or individual subfeatures.

Ref	SAC Interest Feature	Sub-feature	Attribute	Measure	Target	Comments
A12	SAC interest feature 1: Estuaries	Hard substrate habitats and their notable communities	Community composition <i>(extent, variety, spatial distribution and community composition of notable communities - section 4.1.1.v of the conservation objectives)</i>	Assessment of community quality through survey of species composition (presence of typical species) within the notable communities measured periodically	No decline in community quality due to changes in species composition or loss of typical species from an established baseline <i>Baseline to be established : Data to be used : CCW and English Nature Intertidal Biotope Surveys 2006 and future surveys</i>	Different associations of plants, animals and their habitat are an important structural and functional aspect of the feature. Changes in the communities present within an area of a particular type may indicate long-term changes in physical conditions at the site. Typical species of the notable communities to be determined.
A13		Notable estuarine species assemblages : Assemblage of fish species	Abundance <i>(abundance of notable estuarine species assemblages - section 4.1.1.vi of the conservation objectives)</i>	Numbers of species and population estimates	No significant reduction in overall diversity of species or in individual populations against an established baseline <i>Baseline to be established : Data to be used : Environment Agency and relevant Sea Fisheries Committee data</i>	Loss of notable communities may indicate long term changes in the physical conditions of the estuaries interest feature or individual subfeatures. Assemblage of fish species: (Refer to section 4.1.1 note 7) • Migratory species (see also section of this table which relates to the river lamprey, sea lamprey and twaite shad features) • Estuarine species • Marine species • Freshwater species Refer also to section 4.3.2 in relation to the assemblage of migratory fish species of the Ramsar Site.
A14		Notable estuarine species assemblages : Assemblage of waterfowl species	Abundance <i>(abundance of notable estuarine species assemblages - section 4.1.1.vi of the conservation objectives)</i>	Numbers of species and individual population sizes	No significant reduction in overall diversity of species or in individual populations against an established baseline <i>Baselines are identified in the SPA section of this advice – see section 4.2</i>	Loss of notable communities may indicate long term changes in the physical conditions of the estuaries interest feature or individual subfeatures. Refer also to section 4.2.7 in relation to the Internationally important assemblage of waterfowl of the Severn Estuary SPA and section 4.3.9 in relation to the Internationally important assemblage of waterfowl of the Severn Estuary Ramsar Site
A15		Notable estuarine species assemblages : Assemblage of vascular plant species	Abundance of saltmarsh species <i>(abundance of notable estuarine species assemblages - section 4.1.1.vi of the conservation objectives)</i>	Number of species and population sizes	No significant reduction in overall diversity of species or in individual populations against an established baseline <i>Baselines to be established: Data to be used is 1998 NVC Scarce plant survey, county botanical records and CCW/NE site records</i>	Loss of notable communities may indicate long term changes in the physical conditions of the estuaries interest feature or individual subfeatures. Assemblage of vascular plant species includes: • Salt marsh species Note : maintaining the conditions necessary for these species are covered by the Atlantic salt meadows table attributes Table 11

Ref	SAC Interest Feature	Sub-feature	Attribute	Measure	Target	Comments
A16	SAC interest feature 1: Estuaries	Notable estuarine species assemblages : Assemblage of vascular plant species	Abundance of Eel grass	Extent and density of Eel grass species	No significant reduction in overall extent and density against as established baseline <i>Baseline is CCW and English Nature Intertidal Biotope Surveys 2006 plus Severn Second Crossing monitoring data 1989-95/6</i>	Assemblage of vascular plant species includes: • Eel grass (<i>Zostera</i>) species.
A17		All sub-features	Water quality – physico-chemical parameters (Including temperature, salinity, oxygen, nutrients, pH and turbidity etc) <i>(physico chemical characteristics of the water column - section 4.1.1.vii of the conservation objectives)</i>	Physico-chemical parameters measured periodically throughout the reporting cycle (frequency to be determined).	Physico-chemical parameters should not pose a risk to the ecology* of the habitats and species of the SAC, SPA or Ramsar Site. Levels should comply with targets established under the EA Review of Consents and the Water Framework Directive.	Changes in any of the physico-chemical parameters in the water column can impact on the quality of the estuary habitat and hence could lead to changes in the presence and distribution of species (along with recruitment processes and spawning behaviour) and those at the edge of their geographic ranges and non-natives. *ie does not compromise the quality, extent, distribution or species composition of habitats or their ability to support species features (eg feeding, breeding, resting) – the outcome sought is the healthy functioning of the estuary.
A18			Phytoplankton <i>(physico chemical characteristics of the water column - section 4.1.1.vii of the conservation objectives)</i>	Average phytoplankton biomass and characteristic species in summer, measured periodically during the reporting cycle.	Growth of phytoplankton does not cause an undesirable disturbance to the estuary habitats and species Levels should comply with targets established under the EA Review of Consents and the Water Framework Directive.	
A19			Macroalgae	Average macroalgal cover and density in summer, measured periodically during the reporting cycle.	Average macroalgal cover and density should not compromise the ecology * of the estuary habitats and species Levels should comply with targets established under the EA Review of Consents and the Water Framework Directive.	*ie does not compromise the quality, extent, distribution or species composition of habitats or their ability to support species features (eg feeding, breeding, resting) – the outcome sought is the healthy functioning of the estuary.

Ref	SAC Interest Feature	Sub-feature	Attribute	Measure	Target	Comments
A20	SAC interest feature 1: Estuaries		Toxic contaminants <i>(toxic contaminants in water column and sediment - section 4.1.1.viii of the conservation objectives)</i>	Toxic contaminants measured periodically throughout the reporting cycle (frequency to be determined).	Toxic contaminants in water column and sediment should be below levels which would pose a risk to the ecology* of the estuary habitats and species Levels should comply with targets established under the EA Review of Consents and the Water Framework Directive	Elevated concentrations of toxic contaminants in the water column and sediment have the potential to cause lethal or sub-lethal harm to any features and sub-features. *ie does not compromise the quality, extent, distribution or species composition of habitats or their ability to support species features (eg feeding, breeding, resting) – the outcome sought is the healthy functioning of the estuary.
A21			Airborne nutrient and contaminants <i>(airborne contaminants - section 4.1.1.ix of the conservation objectives)</i>	Airborne contaminants measured periodically throughout the reporting cycle (frequency to be determined)	No exceedence of critical loads for: Sulphur dioxide - 20µg/m ³ Nitrous Oxides - 30µg/m ³ Ozone - 3000 ppb Ammonia - 3µg/m ³ Nutrient Nitrogen - 30-40 kg/ha/yr.	Critical loads have been defined where possible (www.apis.ac.uk) for the conservation features of the European site. Where the critical load is exceeded features are at risk. As more in depth studies are undertaken critical loads will be altered to reflect best available scientific knowledge. The impacts of air pollution on the vegetation need further investigation. If particularly damaging, point sources (or groups of point sources) can be identified, then emissions should be regulated to reduce the impacts. It will also be very important for wider measures to be taken, at Government and international levels, to reduce air pollution. There is currently insufficient knowledge to make a judgment of the impacts on specific species. Decisions should be made at a site specific level."

Table 9 – Favourable condition table for the “subtidal sandbanks” feature of the Severn Estuary SAC

Ref	SAC Interest Feature	Sub-feature	Attribute	Measure	Target	Comments
B1	SAC interest feature 2: Subtidal Sandbanks	All sub-features	Extent of feature <i>(total extent of subtidal sandbanks - section 4.1.2.i of the conservation objectives)</i>	Total extent assessed periodically against baseline map (using bathymetry data, and other geophysical techniques (e.g. sidescan sonar), and sediment grain-size data)	No decrease in extent of subtidal sandbanks features from an established baseline, subject to natural processes. <i>Baseline is taken from 1994 admiralty charts, BGS seabed sediment data and sediment environments defined in the Bristol Channel Marine Aggregates Study (Posford Duvivier and ABP Research Consultancy, 2000).</i> <i>Refer also to Map in Appendix 3</i>	Extent is an attribute on which reporting is required by the Habitats Directive. Within the Severn the subtidal sandbanks feature includes both relatively permanent and stable banks (shown in Appendix XX as subtidal sandbanks) and more ephemeral banks which contribute sediment to the sandbanks (shown in Appendix XX as associated sediments) and which are therefore considered to be an integral part of the feature In the long term loss of subtidal sandbank feature communities is likely to be detrimental to the structure of this interest feature and the intertidal mudflats and sandflats features, e.g. associated with a change in sediment budget or geomorphological regime, and may indicate long term changes in the physical conditions of the estuaries interest feature.
B2		All sub-features	Extent of the subtidal sandbank communities <i>(extent of subtidal sandbank communities -section 4.1.2.ii of the conservation objectives)</i>	Extent of subtidal sandbank communities within the site assessed periodically (method and frequency to be determined).	No decrease in extent of the communities from an established baseline subject to natural processes. <i>Baseline is data held on Marine Recorder</i>	The subtidal sandbanks feature comprises two sub-features Sublittoral sands and muddy sand : This sub-feature comprises the following four communities: • Infralittoral mobile sand in variable salinity • Infralittoral mobile clean sands with sparse fauna • Nephtys cirrosa and Macoma balthica in variable salinity infralittoral mobile sand • Neomysis integer and Gammarus spp in fluctuating low salinity infralittoral mobile sand Sublittoral cohesive mud and sandy mud communities This sub-feature comprises the following four communities: • Capitella capitata in enriched sublittoral muddy sediments • Nephtys hombergii and Tubificiodes spp. In variable salinity infralittoral soft mud • Capitella capitata and Tubificiodes spp. In reduced salinity infralittoral muddy sediment • Nephtys hombergii and Macoma balthica in infralittoral sandy mud

Ref	SAC Interest Feature	Sub-feature	Attribute	Measure	Target	Comments
B3	SAC interest feature 2: Subtidal Sandbanks		Distribution of subtidal sandbank communities <i>(extent of subtidal sandbank communities -section 4.1.2.ii of the conservation objectives)</i>	Spatial distribution of subtidal sandbank communities measured periodically (frequency to be determined).	No significant change in the macro scale distribution of the communities from an established baseline subject to natural processes <i>Baseline is data held on Marine Recorder</i>	Some biotopes occur in a natural cycle linked to the dynamism of the prevailing conditions, and these may naturally appear and disappear over time. The feature should not be considered in unfavourable condition due to the short-term disappearance of such ephemeral biotopes
B4			Community composition <i>(community composition of the subtidal sandbank communities -section 4.1.2.iii of the conservation objectives)</i>	Assessment of community quality through survey of species composition within the subtidal sandbank feature measured periodically	No decline in community quality due to changes in species composition or loss of typical species from an established baseline subject to natural processes <i>Baseline is data held on Marine Recorder and EA WFD benthic sampling data</i>	Different associations of plants, animals and their habitat are an important structural and functional aspect of the feature. Changes in the communities present within an area of a particular type of sediment may indicate long-term changes in physical conditions at the site. Typical species of the subtidal sandbanks communities include: <i>Aricidea minuta</i> , <i>Capitella capitata</i> , <i>Diastylis rathkei</i> typical, <i>Eurydice pulchra</i> , <i>Gammarus salinus</i> , <i>Harpinia pectinata</i> , <i>Mediomastus fragilis</i> , <i>Nephtys cirrosa</i> , <i>Nephtys hombergii</i> , <i>Oligochaeta</i> , <i>Pygospio elegans</i> , <i>Pontocrates arenarius</i> , <i>Pseudocuma longicornis</i> , <i>Retusa obtusa</i> , <i>Tubificoides amplivasatus</i>
B5		All sub-features	Sediment character <i>(variety & distribution of sediment types - section 4.1.2.iv of the conservation objectives)</i>	Distribution of sediment types/grain sizes assessed across the site	No major change in composition of sediment type across the feature against an established baseline subject to natural processes <i>Baseline to be established Data to be used is BGS seabed sediment data and other relevant datasets</i>	

Ref	SAC Interest Feature	Sub-feature	Attribute	Measure	Target	Comments
B6	SAC interest feature 2: Subtidal Sandbanks	All sub-features	Topography <i>(gross morphology – depth distribution and profile of subtidal sandbank feature - section 4.1.2.v of the conservation objectives)</i>	Depth distribution/profile of the sandbank feature measured across the site	No major alteration of topography of the subtidal sandbank feature against an established baseline <i>Baseline to be established Data to be used is Hydrographic Office bathymetric data and other relevant bathymetric datasets</i>	

Table 10 – Favourable condition table for the “intertidal mudflats and sandflats” feature of the Severn Estuary SAC

Ref	SAC Interest Feature	Sub-feature	Attribute	Measure	Target	Comments
C1	SAC interest feature 3: Mudflats and sandflats	All sub-features	Extent of the feature <i>(total extent of the mudflats and sandflats feature - section 4.1.3.i of the conservation objectives)</i>	Total area (ha) of the intertidal mudflat and sandflat feature measured periodically during the reporting cycle using a combination of remote sensing and ground truthing of boundaries between communities using GPS (frequency to be determined).	No decrease in extent of intertidal mudflats and sandflats from an established baseline, subject to natural processes. <i>Baseline is aerial photography dated 1999 and CCW/English Nature Intertidal Biotope Surveys 2006. (Note air photo coverage from 1988 gives data for assessing trends in change of this attribute.) Refer also to maps in Appendix 4</i>	Extent is an attribute on which reporting is required by the Habitats Directive. In the long term loss of intertidal mudflat / sandflat communities is likely to be detrimental to the structure of the interest feature, e.g. associated with a change in sediment budget or geomorphological regime, and may indicate long term changes in the physical conditions of the estuaries interest feature. Some fluctuations in extent may occur which are directly attributable to natural coastal processes. These include reduced extent following storms or due to a change to another feature habitat such as saltmarsh. Such types of change in extent would form under the umbrella of ‘natural change’
C2		All sub-features	Extent and variety of the mudflats and sandflats communities comprising each sub-feature <i>(variety and extent of the mudflat and sandflats communities – section 4.1.3.ii of the conservation objectives)</i>	Extent and range of types of intertidal mudflat and sandflat communities assessed along a sampling transect or grid and rapid phase 1 survey techniques using GPS (frequency to be determined).	No decrease in the extent or range of types of intertidal mudflat and sandflat communities from an established baseline, subject to natural processes <i>Baseline is CCW/English Nature Intertidal Biotope Surveys 2006.</i>	Intertidal mudflat and sand flat feature comprises three sub-features: Intertidal gravel and clean sand communities • Barren coarse sand shores; • Burrowing amphipods and <i>Eurydice pulchra</i> in well drained clean sand shores; • Burrowing amphipods and polychaetes in clean sand shores. • Talitrid amphipods in decomposing seaweed on the strandline • Dense <i>Janice conchilega</i> in tide-swept lower shore sand • Barren shingle or gravel shores Intertidal muddy sand communities • Polychaetes and <i>Cerastoderma edule</i> in fine sand or muddy sand shores • <i>Bathyporeia pilosa</i> and <i>Corophium</i> spp. in upper shore slightly muddy fine sand shores • <i>Macoma balthica</i> and <i>Arenicola marina</i> in muddy sand shores. • <i>Arenicola marina</i>, <i>Macoma balthica</i> and <i>Mya arenaria</i> in muddy sand shores. • <i>Echinocardium cordatum</i> and <i>Ensis</i> sp. in lower shore or shallow sublittoral muddy fine sand Intertidal mud communities • <i>Hediste diversicolor</i> and <i>Macoma balthica</i> in sandy mud shores • <i>Hediste diversicolor</i>, <i>Macoma balthica</i> and <i>Arenicola marina</i> in muddy sand or sandy mud shores • <i>Hediste diversicolor</i>, <i>Macoma balthica</i> and <i>Mya arenaria</i> in sandy mud shores • <i>Hediste diversicolor</i> and <i>Scrobicularia plana</i> in reduced salinity mud shores • <i>Hediste diversicolor</i> and oligochaetes in low salinity mud shores

Ref	SAC Interest Feature	Sub-feature	Attribute	Measure	Target	Comments
C3	SAC interest feature 3: Mudflats and sandflats	All subfeatures	Distribution of mudflats and sandflats communities (distribution of communities - section 4.1.3.iii of the conservation objectives)	Spatial distribution of mudflat and sandflat communities assessed along a sampling transect or grid and rapid phase 1 survey techniques using GPS (frequency to be determined).	Macro scale distribution of communities should not deviate significantly from an established baseline, subject to natural processes. <i>Baseline is CCW/English Nature Intertidal Biotope Surveys 2006.</i>	Changes in the spatial distribution of biotopes within an area of a particular type of sediment may provide the first indications of long-term changes in physical conditions at the site. Some biotopes occur in a natural cycle linked to the dynamism of the prevailing conditions, and these may naturally appear and disappear over time. The feature should not be considered in unfavourable condition due to the short-term disappearance of such ephemeral biotopes.
C4		All subfeatures	Community composition (community composition of the feature - section 4.1.3.iv of the conservation objectives)	Assessment of community quality through survey of species composition (presence of typical species) within the intertidal mudflats and sandflats feature measured periodically	No decline in community quality due to changes in species composition or loss of typical species from an established baseline, subject to natural processes. <i>Baseline is CCW/English Nature Intertidal Biotope Surveys 2006.</i>	Different associations of plants, animals and their habitat are an important structural and functional aspect of the feature. Changes in the communities present within an area of a particular type of sediment may indicate long-term changes in physical conditions at the site. Typical species of the intertidal mudflats and sandflats communities include: <i>Aphelocheata marioni</i> , <i>Arenicola marina</i> , <i>Bathyporeia pelagica</i> , <i>Corophium volutator</i> , <i>Enchytraeidae</i> , <i>Eurydice pulchra</i> , <i>Hediste diversicolor</i> , <i>Hydrobia ulvae</i> , <i>Macoma balthica</i> , <i>Nephtys cirrosa</i> , <i>Nephtys hombergii</i> , <i>Oligochaeta indet</i> , <i>Pygospio elegans</i> , <i>Scoloplos armiger</i> , <i>Scrobicularia plana</i> , <i>Streblospio shrubsolii</i> , <i>Tubificoides benedii</i>
C5			Topography (Topography and morphology of the intertidal flats -section 4.1.3v of the conservation objectives)	Tidal elevation and intertidal slope, measured along a series of transects across the estuary periodically during the reporting cycle using remote sensing or traditional surveying techniques (transect locations and survey frequency to be determined).	Intertidal profile should not deviate significantly from an established baseline, subject to natural processes. <i>Baseline to be established: Data to be used is Environment Agency LIDAR survey</i>	In the intertidal zone topography reflects the energy conditions and stability of the sediment, which is key to the structure of the interest feature. Topography is a major influence on the distribution of communities throughout the intertidal flats. Assessing topography also provides information on the position of channels through the interest feature.
C6			Sediment character	Particle size analysis (PSA). measured at a series of locations across the estuary. Locations and frequency to be determined	Average PSA parameters should not deviate significantly from an established baseline. <i>Baseline to be established Data to be used CCW/English Nature Intertidal Biotope Surveys 2006, BGS seabed sediment data and other relevant data sources</i>	Parameters include percentage sand / silt / gravel, mean and median grain size, and sorting coefficient, used to characterise sediment type Sediment character defined by particle size analysis is key to the structure of the feature, and reflects all of the physical processes acting on it. Particle size composition varies across the feature and can be used to indicate spatial distribution of sediment types thus reflecting the stability of the feature and the processes supporting it.

Ref	SAC Interest Feature	Sub-feature	Attribute	Measure	Target	Comments
C7	SAC interest feature 3: Mudflats and sandflats			Sediment penetrability (degree of sinking) measured at a series of locations across the estuary (methodology, locations and frequency to be determined).	Average measure should not deviate significantly from an established baseline. <i>Baseline to be established by future survey</i>	Penetrability is an indicator of sediment stability and degree of compaction; it indicates the shear strength of the sediment and thus the susceptibility of that sediment type to erosion. Compaction of the sediment influences the biological community within the sediment. Penetrability of the sediment is determined by a combination of grain size and water content, which may provide a surrogate index of the penetrability of the sediments.
C8				Sediment organic content (% carbon) measured at a series of locations across the estuary (sampling locations and frequency to be determined).	Average organic carbon content should not deviate significantly from an established baseline. <i>Baseline to be established by future survey</i>	Organic content critically influences the infaunal community and can cause deoxygenation of the feature, which can be detrimental to the biota. However, a balance needs to be struck as organic content provides a measure of the material available to detritivores. A reduction in organic content could lead to a reduction in detritivores, with subsequent knock on effects throughout the food chain.
C9				Oxidation - reduction potential (depth of black anoxic layer) measured at a series of locations across the estuary (sampling locations and frequency to be determined).	Average black layer depth should not deviate significantly from an established baseline. <i>Baseline to be established by future survey</i>	Degree of oxidation / reduction, reflecting oxygen availability within the sediment, critically influences the infaunal community and the mobility of chemical compounds. It is an indicator of the structure of the feature.

Table 11 – Favourable condition table for the “Atlantic salt meadows” feature of the Severn Estuary SAC

Ref	SAC Interest Feature	Sub-feature	Attribute	Measure	Target	Comments
D1	SAC interest feature 4: Atlantic salt meadows	All sub-features	Extent of Atlantic salt meadow (and transitional habitats) feature <i>(extent of Atlantic salt meadow (and transitional habitats) feature - section 4.1.4.i of the conservation objectives)</i>	Total area (ha) of the Atlantic salt meadow feature (and associated transitional habitats) within the site measured periodically during the reporting cycle using a combination of remote sensing and ground truthing of boundaries between communities using GPS (frequency to be determined).	No decrease in total extent of Atlantic salt meadow and associated transitional habitats from the established baseline. <i>Baseline is the CCW/English Nature Saltmarsh NVC survey by Dargie 1998</i> <i>Refer also to maps in Appendix 5</i>	Extent is an attribute on which reporting is required by the Habitats Directive. Monitoring will need to take account of the dynamic nature of these habitats and seasonal and periodic random variations in vegetation types. Coastal squeeze may result in the replacement of Atlantic salt meadows with pioneer saltmarsh. A reduction in extent could be further evaluated by a ground survey to assess for signs of erosion such as toppled vegetation blocks, signs of roots in intertidal mud, signs of stress/damage to plants. Extent needs to be measured at low tide.
D2		All sub-features	Extent of the Atlantic salt meadow communities and associated transitional vegetation communities <i>(extent and distribution of atlantic salt meadow and associated transitional vegetation communities - section 4.1.4.ii of the conservation objectives)</i>	Area (ha) of Atlantic salt meadow and associated transitional vegetation communities within the site measured periodically during the reporting cycle using a combination of remote sensing and ground truthing of boundaries between communities using GPS (frequency to be determined).	No decrease in extent of Atlantic salt meadow and associated transitional vegetation communities from the established baseline subject to natural processes <i>Baseline is the CCW/English Nature Saltmarsh NVC survey by Dargie 1998</i>	Assessment against this target will take account of the effects of the natural process of cyclical development and breakdown of saltmarshes within the Severn which results in the natural succession of saltmarsh communities over time ie the continued presence of all types in proportions reflecting the natural processes operating. Some individual salt marsh communities occur in a natural cycle linked to the dynamism of the prevailing conditions, and these may naturally appear and disappear over time. The feature should not be considered in unfavourable condition due to the short-term disappearance of transient communities. The outcome sought is the maintenance of the general character of the saltmarshes of the Severn in terms of the continued presence, abundance and variation of communities with local differences reflected – it is not to seek the retention of saltmarsh types in situ but to allow them to shift and evolve in line with natural processes The Atlantic salt meadow feature comprises four sub-features: Low to mid marsh communities NVC communities: SM10, SM12, SM13a, SM13b, SM13c, SM13d, SM13x, SM13y, SM14a, SM15. Mid to upper marsh communities NVC communities: SM16a, SM16b, SM16c, SM16d, SM16e, SM16x, SM17, SM18c. Transitional high marsh communities NVC communities: SM23, SM24, SM28, MG11, MG12, MG13, S4a, S21a, S21c. Pioneer saltmarsh communities NVC communities: SM6, SM8, SM9

Ref	SAC Interest Feature	Sub-feature	Attribute	Measure	Target	Comments
D3	SAC interest feature 4: Atlantic salt meadows	All sub-features	Distribution of the Atlantic salt meadow communities and associated transitional vegetation communities <i>(extent and distribution of atlantic salt meadow and associated transitional vegetation communities - section 4.1.4.ii of the conservation objectives)</i>	Spatial distribution of Atlantic saltmeadow and associated transitional vegetation communities measured along a series of fixed transects (or other suitable method to be agreed) periodically during the reporting cycle using GPS (transect locations and frequency of survey to be determined).	The macro scale distribution of communities should not deviate significantly from an established baseline subject to natural processes. <i>Baseline is the CCW/English Nature Saltmarsh NVC survey by Dargie 1998</i>	The distribution of the Atlantic salt meadow communities refers to the macro spatial pattern in which these are distributed around the estuary. This statement does not require micro-distribution of communities (i.e. the exact mapped positions of specific communities to be maintained) but does require the distribution of some saltmarsh types which reflect the differences in estuary structure and function (eg in outer versus inner parts of the estuary, or the influence of freshwater inputs from the rivers) be taken into account. Consideration of this attribute needs to take account of the wider scale and long-term changes and development of saltmarshes in the Severn Estuary which shows a pattern of episodic erosion and accretion evident in a series of saltmarsh terraces. This attribute is also linked with attributes covering zonation and morphology below.
D4		All sub-features	Extent of <i>Spartina anglica</i> <i>(areas of <i>Spartina anglica</i> - section 4.1.4.viii of the conservation objectives)</i>	Total extent of <i>Spartina anglica</i> measured along a series of transects (or other suitable method to be agreed) around the estuary, periodically during the reporting cycle, using a combination of remote sensing and ground survey (transect locations and frequency of survey to be determined).	No increase in total extent of more than 10% over monitoring period; <i>Baseline is the CCW/English Nature Saltmarsh NVC survey by Dargie 1998</i>	<i>Spartina anglica</i> acts as a pioneer species in the Severn and can undergo succession to other saltmarsh habitats over time. As a consequence, although it may be colonising new areas in one part of the estuary, in others it may be developing into more mixed saltmarsh communities. There will be differences in the density, height and cover of the vegetation depending on where it is in the succession. These changes will need to be monitored to establish a baseline and rates of any gross change. An increase in <i>Spartina</i> at the expense of other saltmarsh could indicate changes in the sediment regime and/or tidal levels both in response to natural or anthropogenic processes. Monitoring will only focus on areas of gross expansion of <i>Spartina</i> into intertidal mudflat and saltmarsh communities.
D5		All sub-features	Zonation of vegetation <i>(zonation of Atlantic salt meadow communities - section 4.1.4.iii of the conservation objectives)</i>	Width of pioneer, low-mid marsh, mid-upper marsh, and transitional high marsh saltmarsh zones, measured along a series of transects (or other suitable method to be agreed) around the estuary, periodically during the reporting cycle, using a combination of remote sensing and ground survey (transect locations and frequency of survey to be determined).	The range of variation of zonation of saltmarsh communities around the estuary should not deviate significantly from an established baseline, subject to natural processes. <i>Baseline is CCW/English Nature Saltmarsh NVC survey by Dargie 1998 (and English Nature condition assessment data collected in 2002 for Gloucestershire section of the estuary).</i>	Assessment against this target will take account of the effects of the natural process of cyclical development and breakdown of saltmarshes within the Severn which results in the natural succession of saltmarsh communities and changes to the zonation over time . ie the continued presence of all zones in proportions reflecting the natural processes operating. The outcome sought is the maintenance of the general character of the saltmarshes of the Severn in terms of the continued presence and variation of the saltmarsh zones with local differences reflected – it is not to seek the retention of zones in situ but to allow them to shift and evolve in line with natural processes

Ref	SAC Interest Feature	Sub-feature	Attribute	Measure	Target	Comments
D6	SAC interest feature 4: Atlantic salt meadows	Low to mid marsh communities	Species composition <i>(abundance of typical species - section 4.1.4.iv of the conservation objectives)</i>	Frequency of typical species to be measured using methodology to be agreed (e.g. transects, plots etc) once during reporting cycle	Frequency of typical species of characteristic low to mid marsh communities should not deviate significantly from an established baseline. <i>Baseline is CCW/English Nature Saltmarsh NVC survey by Dargie 1998</i>	The typical species for these communities include: <i>Puccinellia maritima, Salicornia spp., Suaeda maritima, Aster tripolium, Spergularia marginata, Glaux maritima, Plantago maritima, Atriplex glabriuscula, Atriplex prostrata, Triglochin maritima, Limonium vulgare, Armeria maritima and Juncus maritimus</i> *This target should not however prevent the enhancement of the diversity of swards where possible eg through the encouragement of a wider range of herbs through relaxation of grazing pressure in heavily grazed areas.
D7		Mid to upper marsh communities	Species composition <i>(abundance of typical species - section 4.1.4.iv of the conservation objectives)</i>	Frequency of typical species to be measured using methodology to be agreed (e.g. transects, plots etc) once during reporting cycle	Frequency of typical species of characteristic mid to upper marsh communities should not deviate significantly from an established baseline. <i>Baseline is CCW/English Nature Saltmarsh NVC survey by Dargie 1998</i>	The typical species for these communities include : <i>Puccinellia maritima, Aster tripolium, Glaux maritima, Plantago maritima, Festuca rubra, Juncus gerardii, Triglochin maritima, , Agrostis stolonifera, Juncus maritimus , Spergularia marginata, Parapholis strigosa, Elymus pycnanthus,, Hordeum secalinum, Trifolium fragiferum and Atriplex glabriuscula,</i> *(see note above)
D8		Transitional high marsh communities	Species composition <i>(abundance of typical species - section 4.1.4.iv of the conservation objectives)</i>	Frequency of typical species to be measured using methodology to be agreed (e.g. transects, plots etc) once during reporting cycle	Frequency of typical species of characteristic high marsh communities should not deviate significantly from an established baseline. <i>Baseline is CCW/English Nature Saltmarsh NVC survey by Dargie 1998</i>	The typical species for these communities include: <i>Puccinellia distans, Puccinellia maritima, Puccinellia rupestris, Plantago coronopus, Parapholis strigosa, Atriplex glabriuscula, Spergularia marina, Festuca rubra, Agrostis stolonifera, Aster tripolium, Hordeum secalinum, Elymus pycnanthus, Elymus repens, Potentilla anserina, Lolium perenne, Alopecurus geniculatus, Phragmites australis, Bolboschoenus maritimus, Festuca arundinacea,</i> *(see note above)
D9		Pioneer saltmarsh communities	Species composition <i>(abundance of typical species - section 4.1.4.iv of the conservation objectives)</i>	Frequency of typical species to be measured using methodology to be agreed (e.g. transects, plots etc) once during reporting cycle	Frequency of typical species of characteristic pioneer marsh communities should not deviate significantly from an established baseline. <i>Baseline is CCW/English Nature Saltmarsh NVC survey by Dargie 1998</i>	The typical species for these communities include : <i>Spartina anglica, Salicornia sp, Suaeda maritima</i>

Ref	SAC Interest Feature	Sub-feature	Attribute	Measure	Target	Comments
D10	SAC interest feature 4: Atlantic salt meadows		Abundance of locally occurring scarce and notable plant species (abundance of notable species - section 4.1.4v of the conservation objectives)	Number of discrete locations within the estuary where scarce and notable species are found and their abundance at each location.	No decrease in abundance of scarce and notable species from an established baseline. <i>Baseline : CCW/English Nature saltmarsh rare/scarce plant survey by Dargie 1998</i> <i>Individual county based records from plant recorders/record centres</i>	Nationally scarce and notable species within the Atlantic salt meadow and associated transitional vegetation communities comprise: Nationally scarce species: <i>Alopecurus bulbosus, Althaea officinalis, Bupleurum tenuissimum, Hordeum marinum, Trifolium squamosum, Puccinellia rupestris, Polygonum raii.</i> Other notable species occurring: <i>Allium oleraceum, Lepidium latifolium, Petroselinum segetum</i> Note that some of the nationally scarce and notable plants require levels of ground disturbance (resulting in openings in the sward) to establish. Localised tight grazing and /or poaching may provide sward openings for such species as well as the wider range of herbs and unless widespread and persistent should not necessarily regarded as a problem.
D11		All sub-features	Sward structure (structural variation of the salt marsh sward - section 4.1.4 vi of the conservation objectives)	Sward height of Atlantic salt meadow communities measured periodically during the reporting cycle in late summer using a combination of remote sensing and field visits.	The extent and distribution of vegetation communities exhibiting different sward heights should not deviate significantly from an established set of limits. The limits will be defined to ensure that the requirements of the typical and notable plants species and birds species designated within the Severn Estuary SPA and Ramsar, can be met <i>Baselines are to be established from Nature Conservancy Council SSSI owner/occupier consent records dating from 1988 Severn Estuary SSSI notification (and subsequent consent reviews)</i> <i>CCW and EN/NE site monitoring records</i>	Vegetation structure is largely affected by the impact of grazing (of wild or domesticated herbivores) interacting with different vegetation communities and ground hydrological conditions. Not all Atlantic salt meadow within the Severn Estuary is grazed, but it is a widespread and long established practice and stocking levels need to be appropriate to the interest of the site. Over grazing can lead to a loss of structural diversity of rare plant species and affect bird use of these habitats while under grazing can lead to a loss of plant diversity by competitive exclusion. Introduction of grazing to previously ungrazed sites can result in deleterious changes to plant community composition and its value for wider conservation interests such as invertebrates. Note that some of the nationally scarce and notable plants require levels of ground disturbance (resulting in openings in the sward) to establish. Localised tight grazing and /or poaching may provide sward openings for such species as well as the wider range of herbs and unless widespread and persistent should not necessarily regarded as a problem. Disturbance is also provided in areas where natural tidal debris accumulates scattered across the salt marsh and in driftlines (often at the base and on the seaward slope of the floodbank). As well as providing seed establishment points for scarce plants the debris also plays a role in creating variation in sward structure particularly in the mid/upper and transition high marsh zones and in supporting important populations of invertebrates (notable deadwood beetles). The continued presence of tidal debris and driftlines in some locations is therefore a desirable aspect of the saltmarsh management which delivers this attribute . They may also be of value for the bird populations which roost and feed on saltmarshes of the SPA and Ramsar Site. (see sections 4.2 and 4.3)

Ref	SAC Interest Feature	Sub-feature	Attribute	Measure	Target	Comments
D12	SAC interest feature 4: Atlantic salt meadows		Morphology <i>(characteristic stepped morphology and associated structural features - section 4.1.4.vii of the conservation objectives)</i>	Location and extent of established morphological features (saltmarsh terracing, creeks, pills, drainage ditches and pans) measured during the reporting cycle using remote sensing and field survey	No anthropogenic alteration of established morphological features from an established baseline. <i>Baselines is taken from 1999 air photos , CCW/English Nature Saltmarsh NVC survey by Dargie 1998 and English Nature condition assessment data collected in 2002 for Gloucestershire section of the estuary.</i>	This target relates to features which have developed naturally as a result of the evolution of the saltmarshes or the presence of freshwater drainage systems entering the estuary and which have established conservation value (eg pill sides of value botanically, pills used for shelter, feeding and roosting by birds). The baseline dataset will establish the location and extent of these features and identify man made features which do not need to meet this target.

Table 12 – Favourable condition table for the “reefs” feature of the Severn Estuary SAC

Ref	SAC Interest Feature	Sub-feature	Attribute	Measure	Target	Comments
E1	SAC interest feature 4: Reefs		(Total) Extent and distribution <i>(total extent and distribution of reef - section 4.1.5.i of the conservation objectives)</i>	Measurement of the extent and distribution of the purely subtidal part of this feature in the Severn Estuary is challenging. Remote sensing methods (such as side scan sonar) and drop down video are unreliable in these conditions. Therefore limited grab sampling may be required. Measurement of the subtidal component at the subtidal/intertidal interface may be possible by direct observation at very low tides. Extent and distribution of the intertidal <i>Sabellaria</i> reef measured using Phase 1 mapping survey techniques	No reduction in the extent and distribution of the reef from an established baseline <i>Baseline is comprised of grab sampling surveys by Mettam 1988 supplemented by Environment Agency data 1999 and data from Warwick et al.2001 which provide subtidal reef records.</i> <i>CCW/English Nature Intertidal Biotope Surveys 2006 identify the distribution of intertidal Sabellaria alveolata and indication of locations for further survey for subtidal Sabellaria contiguous with these intertidal areas.</i>	Known occurrences of subtidal and subtidal contiguous with intertidal reefs are largely limited to the outer parts of the estuary (area seaward of a line drawn between Portishead and Newport). See appendix 6. Samples show that reef formation is not continuous within this area and is in varying stages of growth. Further work is required to establish the distribution of this feature particularly with respect to the subtidal and the intertidal/subtidal interface. A further upstream zone of intertidal <i>Sabellaria</i> populations is recorded up to the old Severn Bridge (Beachley to Aust) . While not part of the reef feature the extent of solely intertidal <i>Sabellaria</i> is relevant as these areas will also contribute larvae to the estuary wide populations of this species. The populations of <i>Sabellaria</i> within the Severn (subtidal, and intertidal) should be regarded as a metapopulation. New technologies that may allow the measurement of <i>Sabellaria</i> reef in a non destructive way should be investigated if they present themselves.
E2			Community composition <i>(community composition - section 4.1.5.ii of the conservation objectives)-</i>	Measurement of the community composition of this feature in the Severn Estuary is challenging. Remote sensing methods (such as side scan sonar) and drop down video are difficult. Therefore limited grab sampling may be required.	New samples of reef show no significant decline in community composition from baseline records <i>Baseline is survey by Mettam 1988 supplemented by Environment Agency data 1999 and data from Warwick et al.2001</i>	The reefs feature comprise two communities : <i>Sabellaria alveolata</i> on variable salinity sublittoral mixed sediment SS.SBR.PoR.SalvMx <i>Sabellaria alveolata</i> reefs on sand-abraded eulittoral rock. LS.LBR.Sab.Salv The typical species associated with subtidal and intertidal reefs in the Severn Estuary, derived from known samples, are listed in section 4.15.1 note 4

Ref	SAC Interest Feature	Sub-feature	Attribute	Measure	Target	Comments
E3	SAC interest feature 4: Reefs		Age structure <i>(full range of age structures - section 4.1.5.iii of the conservation objectives)</i>	Measurement of the community composition of this feature in the Severn Estuary is challenging. Remote sensing methods (such as drop down video) are difficult. Therefore limited grab sampling may be required.	Different phases from newly settled worms through vigorous fast growing reef to older hummocks are present <i>Baseline yet to be established.</i>	<i>Sabellaria alveolata</i> reefs cycle through different phases from newly settled worms through vigorous fast-growing reef to older hummocks. In a stable or increasing population all age phases are likely to be present . The presence of areas of variable stages of growth is important in ensuring larval supply and also enhances the species diversity of the reef
E4			Physical & ecological processes <i>(physical and ecological processes - section 4.1.5.iv of the conservation objectives)</i>	Abundance of coarse sediments Presence of suitable sediment grades in subtidal and intertidal sediments within the defined reefs zone (see comment on extent and distribution above) measured periodically.	No change in the abundance of suitable sediment grades within the defined reefs zone against an established baseline <i>Baseline yet to be established.</i>	An abundance of suitable coarse sediments (0.5-1mm sand) are required to support reef growth (tube building)
E5				Availability of suitable substrates Extent of available suitable (hard or long-term consolidated) substrates within the defined reef zone measured periodically	No change in overall extent of available suitable substrates within the defined reefs zone against an established baseline <i>Baseline yet to be established – data from the BGS and the CCW/English Nature intertidal biotope survey 2006 may assist</i>	Within the Severn reefs have been recorded both on solid geology and on smaller rocks and cobbles.
E6				Supply of larvae Abundance of <i>Sabellaria</i> larvae within the water column measured through plankton sampling	No decrease in the abundance of <i>Sabellaria</i> larvae against an established baseline <i>Baseline yet to be established – data may be available from existing plankton sampling surveys</i>	Area of sampling for this attribute should include both the reef zone and areas where intertidal populations are known as all areas supporting <i>Sabellaria alveolata</i> formations will be supplying larvae to the water column and hence may seed the reef feature. Recruitment is likely to be variable between years.

Ref	SAC Interest Feature	Sub-feature	Attribute	Measure	Target	Comments
E7				Abundance of food in water column Methods to be determined .	No decrease in the abundance of suspended detritus within the water column of the defined reef zone against an established baseline <i>Baseline yet to be established</i>	Area of sampling of the water column should include both the reef zone and intertidal populations (the estuary-wide metapopulation of <i>Sabellaria alveolata</i>)

Table 13 – Favourable condition table for the “river lamprey” and “sea lamprey” features of the Severn Estuary SAC

Ref	SAC Interest Feature	Sub-feature	Attribute	Measure	Target	Comments
F1	SAC interest feature 5: River lamprey <i>Lampetra fluviatilis</i> and SAC interest feature 6: Sea lamprey <i>Petromyzon marinus</i>		Migratory access (Barriers to migration) <i>(migratory passage not impeded - sections 4.1.6.i and 4.1.7.i of the conservation objectives)</i>	Water quality measured regularly throughout the reporting cycle in the Bristol Channel, Severn Estuary, River Wye SAC, River Usk SAC and River Severn. <i>(see also Table 8, lines A17-20 relating to general water quality requirements for the estuary feature (and dependant sub features))</i>	Water quality is sufficient to support migratory passage. Levels (for temperature, salinity, turbidity, pH, and dissolved oxygen) should comply with targets established under the EA Review of Consents and the Water Framework Directive. <i>Baseline is water quality sampling data collected by the Environment Agency</i>	Significant variation in these physico-chemical parameters may act as barriers to migration. For example, the timing, duration and consistency of their upstream migration are believed to be closely related to temperature changes as well as pheromone triggers from the juveniles during periods of high water flow. Peak migration usually coincides with river temperatures that remain above 10°C and continues until temperatures reach 18°C. Dissolved oxygen can also be significantly reduced in stretches receiving significant BOD inputs, or through the re-suspension of organic rich sediments. Toxic contaminants may act as a barrier to migration. Environmental Quality Standards (EQSs) are set for dangerous substances as defined under the Dangerous Substances Directive or Government Policy for freshwater and marine environments
F2				Water flows measured regularly throughout the reporting cycle (frequency to be determined) in the River Wye SAC, River Usk SAC and River Severn <i>(see also Table 8 line A3 relating to general tidal and water flow requirements for the estuary feature (and dependant sub features))</i>	Flows from the river into the estuary must be sufficient to allow migration. <i>Baseline is water flow sampling data collected by the Environment Agency provides a baseline. Severe low flow conditions that affect these species yet to be defined</i>	
F3				Physical barriers Mapping and quantification of potential obstructions in relation to height, type and water depth below obstruction once during the reporting cycle.	No artificial barriers significantly impairing, adults from reaching existing and historical spawning grounds, or juveniles from moving downstream. <i>Baseline is the Environment Agency data on structures and flood defences</i>	Dams, navigation and other weirs may prevent lamprey from reaching their spawning grounds. In particular, sea lamprey is known to be poor at ascending obstacles.

Ref	SAC Interest Feature	Sub-feature	Attribute	Measure	Target	Comments
F4	SAC interest feature 5: River lamprey <i>Lampetra fluviatilis</i> and SAC interest feature 6: Sea lamprey <i>Petromyzon marinus</i>		Population size (returning adults) <i>(size of populations - sections 4.1.6.ii and 4.1.7.ii of the conservation objectives)</i>	Number of returning adults measured using fish counters on the feeding rivers (Wye, Usk and Severn) during the migratory period.	No decline in number of returning adults from established baseline. <i>Baseline is yet to be established - fish counter data may be able to provide a baseline in future years.</i>	(Note that this attribute will not be able to be measured until the technological solutions are developed.) Fish counter technology is being developed to monitor adult lampreys but is not yet installed on the feeding rivers of the Severn Estuary. Fish counter technology should be further developed to monitor migrating adult river and sea lamprey.
F5			Ammocoete population in tributary rivers <i>(size of populations - sections 4.1.6.ii and 4.1.7.ii of the conservation objectives)</i>	Electrofishing surveys in 1m ² quadrats at a series of locations in the Rivers Usk, Wye (and Severn)	River population targets for the Usk and Wye must be met <i>Baseline is the survey of ammocoete abundance and distribution in the Rivers Usk and Wye commissioned by CCW in 2005 (Harvey et al. 2007).</i>	(Note that this attribute will not be able to be measured until the technological solutions are developed.) During the electrofishing survey all ammocoetes should be identified as <i>Lampetra</i> or <i>Petromyzon</i> and measured (mm). Surveys should be undertaken at the earliest in July but preferably between August and October. The rivers fauna CSM state three targets which must be met for the population attribute. These are; 1. Ammocoete population age structure For samples of 50 ammocoetes or less, at least 2 distinct size classes should normally be present. If more than 50 ammocoetes are collected, at least 3 size classes should be present. 2. Ammocoete distribution within catchment Lampreys should be present at not less than 2/3 of sites surveyed. 3. Ammocoete density; a. For <i>lampetra</i> ; Optimal habitat >10m ⁻² Overall catchment mean >5m ⁻² b. For sea lamprey - Ammocoetes should be present in at least sampling sites each not less than 5km apart

Ref	SAC Interest Feature	Sub-feature	Attribute	Measure	Target	Comments
F6			Prey species <i>(abundance of prey species - sections 4.1.6.iii and 4.1.7.iii of the conservation objectives)</i>	The abundance of key prey species measured periodically	No significant reduction in abundance of key prey species against an established baseline <i>Baseline is yet to be established Data to be used is EA monitoring of river and fish populations and future surveys</i>	River and sea lamprey require a variety of other fish species to act as hosts throughout their lifecycle. Their principal host species are part of the estuarine fish assemblage which has measures and targets included within the “estuaries” feature – Table 8

Table 14 – Favourable condition table for the “twaite shad” feature of the Severn Estuary SAC

Ref	SAC Interest Feature	Sub-feature	Attribute	Measure	Target	Comments
G1	SAC interest feature 7: Twait shad (<i>Alosa fallax</i>)		Migratory access (Barriers to migration) (migratory passage not impeded - section 4.1.8.i of the conservation objectives)	Water quality measured regularly throughout the reporting cycle in the Bristol Channel, Severn Estuary, River Wye SAC, River Usk SAC and River Severn. (see also Table 8 line A 17-20 relating to general water quality requirements for the estuary feature (and dependant sub features))	Water quality is sufficient to support migratory passage. Levels (for temperature, salinity, turbidity, pH, and dissolved oxygen) should comply with targets established under the EA Review of Consents and the Water Framework Directive. <i>Baseline is water quality sampling data collected by the Environment Agency</i>	Significant variation in these physico-chemical parameters may act as barriers to migration. For example, the timing, duration and consistency of their upstream migration are believed to be closely related to temperature changes . Peak migration usually coincides with river temperatures that remain above 10°C and continues until temperatures reach 18°C. Dissolved oxygen can also be significantly reduced in stretches receiving significant BOD inputs, or through the resuspension of organic rich sediments. Toxic contaminants may act as a barrier to migration. Environmental Quality Standards (EQSs) are set for dangerous substances as defined under the Dangerous Substances Directive or Government Policy for freshwater and marine environments.
G2				Water flows measured regularly throughout the reporting cycle (frequency to be determined) in the River Wye SAC, River Usk SAC and River Severn (see also Table 8 line A3 relating to general tidal and water flow requirements for the estuary feature (and dependant sub features))	Flows from the river into the estuary must be sufficient to allow migration <i>Baseline is water flow sampling data collected by the Environment Agency provides a baseline. Severe low flow conditions that affect these species yet to be defined</i>	
G3				Physical barriers Mapping and quantification of potential obstructions in relation to height, type and water depth below obstruction once during the reporting cycle.	No artificial barriers significantly impairing, adults from reaching existing and historical spawning grounds, or juveniles from moving downstream. <i>Baseline is Environment Agency data on structures and flood defences</i>	Dams, navigation and other weirs may prevent shad reaching their spawning grounds. In particular, shad are known to be poor at ascending obstacles.

Ref	SAC Interest Feature	Sub-feature	Attribute	Measure	Target	Comments
G4	SAC interest feature 7: Twaite shad (<i>Alosa fallax</i>)		Population size (returning adults) <i>(size of populations - section 4.1.8.ii of the conservation objectives)</i>	Number of returning adults measured using fish counters on the Usk and Wye rivers during the migratory period.	No drop in the annual run size greater than would be expected from variations in natural mortality alone. <i>Baseline is yet to be established - fish counter data may be able to provide a baseline in future years. Noble et al. (2007) provides historical information on returning adults for the River Wye.</i>	(Note that this attribute will not be able to be measured until the technological solutions are developed.) Fish counter technology is being developed to monitor adult shad but is not yet installed on the feeding rivers of the Severn Estuary. Fish counter technology should be further developed to monitor migrating adult shad.
G5			River population <i>(size of populations - section 4.1.8.ii of the conservation objectives)</i>	Seine netting for juveniles in the lower rivers and upper estuaries and monitoring of shad eggs by kick sampling	River population targets for the Usk and Wye must be met <i>Baseline yet to be established. Noble et al. (2007) provides some information on juvenile densities.</i>	(Note that this attribute will not be able to be measured until the technological solutions are developed.) Seine netting should occur in lower rivers and upper estuaries. Netting should be carried out in late summer early autumn (July-October). For each river, juvenile densities should exceed a specified minimum target at least two years in six. The extent of spawning should be monitored by kick sampling for eggs at a proportion of known spawning sites. A reduction in the spawning distribution of more than 50 % compared with the baseline will indicate an adverse change. Kick sampling should occur during May and June.
G6			Prey species <i>(abundance of prey species – section 4.1.8.iii of the conservation objectives))</i>	The abundance of key prey species measured by EA in their routine monitoring of the rivers and estuary	No significant reduction in abundance of key prey species against an established baseline <i>Baseline is yet to be established through fish surveys in estuary and rivers</i>	Twaite shad require a variety of invertebrates including crustacean, mysids and copepods, small fish and fish eggs particularly in that section of the estuary where saline and freshwaters meet.

4.2 Conservation objectives for SPA European Marine Site interest features

The protection and management of the SPA in accordance with Article 6 of the Habitats Directive, including in particular the consideration of plans and projects under Article 6(3) and 6(4), should be carried out in view of the conservation objectives in this section.

Note : The conservation objectives for areas of the SPA which lie outside the European Marine Site boundary are provided in separate documents by CCW and Natural England which are currently in preparation and will soon be available on request.

4.2.1 SPA Interest feature 1: Internationally important population of regularly occurring Annex 1 species : Bewick's swan

The conservation objective is to maintain the Bewick's swan population and its supporting habitats¹ in **favourable condition**, as defined below

The interest feature Bewick's swan will be considered to be in favourable condition when, subject to natural processes², each of the following conditions are met:

- (i) the 5 year peak mean population size for the Bewick's swan population is no less than 289 individuals (ie the 5 year peak mean between 1988/9 - 1992/3);
- (ii) the extent of saltmarsh at the Dumbles (Appendix 8: Map 1) is maintained;
- (iii) the extent of intertidal mudflats and sandflats at Frampton Sands, Waveridge Sands and the Noose (Appendix 8: Map 1) is maintained;
- (iv) the extent of vegetation with an effective field size of >6 ha and with unrestricted bird sightlines > 500m at feeding, roosting and refuge sites (Appendix III) are maintained;
- (v) greater than 25% cover of suitable soft leaved herbs and grasses³ in winter season throughout the transitional saltmarsh at the Dumbles (Appendix 8: Map 1) is maintained;
- (vi) aggregations of Bewick's swan at feeding, roosting and refuge sites are not subject to significant disturbance.

4.2.1.1 Explanatory information for the Bewick's swan conservation objective

¹ Key supporting habitats for the Annex I species

- Intertidal mudflats and sandflats
- Saltmarsh

² Natural processes in respect of the SPA

Each interest feature is subject to both natural processes and human influences. Human influence on the interest features is acceptable provided that it is compatible with the achievement of the conditions set out under the definition of favourable condition for each interest feature. A failure to meet these conditions which is entirely a result of natural processes will not constitute unfavourable condition, but will trigger a review of the definition of favourable condition. This qualification is necessary because:

- (a) the bird populations themselves are subject to natural factors, many of which arise outside the SPA, such as breeding success and winter temperatures;

(b) the supporting habitats of the birds are influenced by the evolution of the estuary. Natural adjustments within estuaries can take many forms. One important example is the tendency of estuaries to accumulate sediment, thereby changing their form from their original Holocene morphology to a state where tidal energy is dissipated by subtidal and intertidal sediment banks or features. This, with other natural processes, will therefore cause the width and depth of the estuary to change over time, moving towards a state of dynamic equilibrium or 'most probable state'. As part of this process, the location and extent of saltmarshes and mudflats may change, provided there is capacity to accommodate readjustment. However, where this process is constrained, the capacity of habitats to accommodate readjustment may be affected.

³Key food plants of Bewick's swan

eg *Agrostis stolonifera*, *Alopecurus geniculatus*, *Glyceria geniculatus*. (This list contains examples and is not exhaustive)

4.2.2 SPA interest feature 2: Internationally important population of regularly occurring migratory species: wintering European white-fronted goose

The conservation objective is to maintain the European white-fronted goose population and its supporting habitats¹ in **favourable condition**, as defined below.

The interest feature European white-fronted goose will be considered to be in favourable condition² when, subject to natural processes², each of the following conditions are met:

- (i) the 5 year peak mean population size for the wintering European white fronted goose population is no less than 3,002 individuals (ie the 5 year peak mean between 1988/9-1992/3);
- (ii) the extent of saltmarsh at the Dumbles (Appendix 8: Map 1) is maintained;
- (iii) the extent of intertidal mudflats and sandflats at Frampton Sands, Waveridge Sands and the Noose (Appendix 8: Map 1) is maintained;
- (iv) greater than 25% cover of suitable soft-leaved herbs and grasses³ is maintained during the winter on saltmarsh areas (Appendix 8: Map 1);
- (v) unrestricted bird sightlines of >200m at feeding and roosting sites are maintained;
- (vi) aggregations of European white-fronted goose at feeding or roosting sites are not subject to significant disturbance.

4.2.2.1 Explanatory information for the wintering European white-fronted goose objective

¹Key supporting habitats for the migratory bird species

- Intertidal mudflats and sandflats
- Saltmarsh

²Natural processes in respect of the SPA

The meaning of 'natural processes' is explained in **section 4.2.1.1**.

³Key food plants of European white-fronted goose

eg *Alopecurus bulbosus*, *Festuca rubra*, *Hordeum marinum*, *Lolium perenne*; *Puccinellia maritima*.
(This list contains examples and is not exhaustive)

4.2.3 SPA interest feature 3: Internationally important population of regularly occurring migratory species: wintering dunlin

The conservation objective is to maintain the dunlin population and its supporting habitats¹ in **favourable condition**, as defined below:

The interest feature dunlin will be considered to be in favourable condition when, subject to natural processes², each of the following conditions are met:

- (i) the 5 year peak mean population size for the wintering dunlin population is no less than 41,683 individuals (ie the 5 year peak mean between 1988/9 - 1992/3);
- (ii) the extent of saltmarsh (Appendix 8) and associated strandlines is maintained;
- (iii) the extent of intertidal mudflats and sandflats (Appendix 8) is maintained;
- (iv) the extent of hard substrate habitats (Appendix 8) is maintained;
- (v) the extent of vegetation with a sward height of <10cm is maintained throughout the saltmarsh (Appendix 8);
- (vi) the abundance and macro-distribution of suitable invertebrates³ in intertidal mudflats and sandflats (Appendix 8) is maintained;
- (vii) the abundance and macro-distribution of suitable invertebrates³ in hard substrate habitats (Appendix 8) is maintained;
- (viii) unrestricted bird sightlines of >200m at feeding and roosting sites are maintained;
- (ix) aggregations of dunlin at feeding or roosting sites are not subject to significant disturbance.

4.2.3.1 Explanatory information for the wintering dunlin objective

¹Key supporting habitats for the migratory bird species

- Intertidal mudflats and sandflats
- Saltmarsh
- Hard substrate habitats (rocky shores)

²Natural processes in respect of the SPA

The meaning of 'natural processes' is explained in **section 4.2.1.1**.

³Key intertidal invertebrate prey species of dunlin

eg *Carcinus*, *Crangon*, *Hydrobia*, *Macoma*, *Hediste*, and *Talitrus* spp.
(This list contains examples and is not exhaustive)

4.2.4 SPA interest feature 4: Internationally important population of regularly occurring migratory species: wintering redshank

The conservation objective is to maintain the redshank population and its supporting habitats¹ in **favourable condition**, as defined below

The interest feature redshank will be considered to be in favourable condition when, subject to natural processes² each of the following conditions are met:

- (i) the 5 year peak mean population size for the wintering redshank population is no less than 2,013 individuals (ie the 5 year peak mean between 1988/9 - 1992/3);
- (ii) the extent of saltmarsh (Appendix 8) and associated strandlines is maintained;
- (iii) the extent of intertidal mudflats and sandflats (Appendix 8) is maintained;
- (iv) the extent of hard substrate habitats (Appendix IV) is maintained;
- (v) the extent of vegetation with a sward height of <10cm throughout the saltmarsh (Appendix 8) is maintained;
- (vi) the abundance and macro-distribution of suitable invertebrates³ in intertidal mudflats and sandflats (Appendix 8) is maintained;
- (vii) the abundance and macro-distribution of suitable invertebrates³ in hard substrate habitats (Appendix 8) is maintained;
- (viii) unrestricted bird sightlines of >200m at feeding and roosting sites are maintained;
- (ix) aggregations of redshank at feeding or roosting sites are not subject to significant disturbance.

4.2.4.1 Explanatory information for the wintering redshank objective

¹Key supporting habitats for the migratory bird species

- **Intertidal mudflats and sandflats**
- **Saltmarsh**
- **Hard substrate habitats (rocky shores)**

²Natural processes in respect of the SPA

The meaning of 'natural processes' is explained in **section 4.2.1.1**.

³Key intertidal invertebrate prey species of redshank

eg *Carcinus*, *Crangon*, *Hydrobia*, *Macoma*, *Hediste*, and *Talitrus* spp.
(This list contains examples and is not exhaustive)

4.2.5 SPA interest feature 5: Internationally important population of regularly occurring migratory species: wintering shelduck

The conservation objective is to maintain the shelduck population and its supporting habitats¹ in **favourable condition**, as defined below:

The interest feature shelduck will be considered to be in favourable condition when, subject to natural processes², each of the following conditions are met:

- (i) the 5 year peak mean population size for the wintering shelduck population is no less than 2,892 individuals (ie the 5 year peak mean between 1988/9 - 1992/3);
- (ii) the extent of saltmarsh (Appendix 8) is maintained;
- (iii) the extent of intertidal mudflats and sandflats (Appendix 8) is maintained;
- (iv) the extent of hard substrate habitats (Appendix 8) is maintained;
- (v) the abundance and macro-distribution of suitable invertebrates³ in intertidal mudflats and sandflats (Appendix 8) is maintained;
- (vi) unrestricted bird sightlines of >200m at feeding and roosting sites are maintained;
- (vii) aggregations of shelduck at feeding or roosting sites are not subject to significant disturbance.

4.2.5.1 Explanatory information for the wintering shelduck objective

¹Key supporting habitats for the migratory bird species

- Intertidal mudflats and sandflats
- Saltmarsh
- Hard substrate habitats (rocky shores)

²Natural processes in respect of the SPA

The meaning of 'natural processes' is explained in **section 4.2.1.1**.

³Key intertidal invertebrate prey species of shelduck

eg *Carcinus*, *Corophium*, *Hydrobia*, *Macoma*, *Mytilus*, and *Hediste* spp
(This list contains examples and is not exhaustive)

4.2.6 SPA interest feature 6: Internationally important population of regularly occurring migratory species: wintering gadwall

The conservation objective is to maintain the gadwall population and its supporting habitats¹ in **favourable condition**, as defined below:

The interest feature gadwall will be considered to be in favourable condition when, subject to natural processes², each of the following conditions are met:

- (i) the 5 year peak mean population size for the wintering gadwall population is no less than 330 (ie the 5 year peak mean between 1988/9 - 1992/3);
- (ii) the extent of intertidal mudflats and sandflats (Appendix 8) is maintained;
- (iii) unrestricted bird sightlines of >200m at feeding and roosting sites are maintained;
- (iv) aggregations of gadwall at feeding or roosting sites are not subject to significant disturbance.

4.2.6.1 Explanatory information for the wintering gadwall objective

¹Key supporting habitats for the migratory bird species

- **Intertidal mudflats and sandflats**

Note : It is currently unclear what use this species is making of the estuary – they are clearly present in intertidal areas particularly around areas freshwater streams and pills enter the estuary. Although primarily freshwater plant feeders they do also take animal material including insects, molluscs, annelids and even small fish and small amphibians – it is possible that they are feeding on such matter in the freshwater influenced mud and sands. Recent evidence indicates this species is changing its general habits as it extends its range westwards. As a result the conservation objective for this species does not include a condition in respect of the key food sources as for other species at this time.

²Natural processes in respect of the SPA

The meaning of ‘natural processes’ is explained in **section 4.2.1.1**.

4.2.7 SPA interest feature 7: Internationally important assemblage of waterfowl

The conservation objective is to maintain the waterfowl assemblage and its supporting habitats¹ in **favourable condition**, as defined below:

The interest feature waterfowl assemblage will be considered to be in favourable condition when, subject to natural processes², each of the following conditions are met:

- (i) the 5 year peak mean population size for the waterfowl assemblage is no less than 68,026 individuals (ie the 5 year peak mean between 1988/9 - 1992/3);
- (ii) the extent of saltmarsh (Appendix 8) and their associated strandlines is maintained;
- (iii) the extent of intertidal mudflats and sandflats (Appendix 8) is maintained;
- (iv) the extent of hard substrate habitats (Appendix 8) is maintained;
- (v) extent of vegetation of <10cm throughout the saltmarsh (Appendix 8) is maintained;
- (vi) the abundance and macroscale distribution of suitable invertebrates³ in intertidal mudflats and sandflats (Appendix 8) is maintained;
- (vii) the abundance and macroscale distribution of suitable invertebrates³ in hard substrate habitats (Appendix IV) is maintained;
- (viii) greater than 25% cover of suitable soft leaved herbs and grasses⁴ during the winter on saltmarsh areas (Appendix 8) is maintained;
- (ix) unrestricted bird sightlines of >500m at feeding and roosting sites are maintained;
- (x) waterfowl aggregations at feeding or roosting sites are not subject to significant disturbance.

4.2.7.1 Explanatory information for the internationally important assemblage of waterfowl

¹Key supporting habitats for the waterfowl assemblage¹

- Intertidal mudflats and sandflats
- Saltmarsh
- Hard substrate habitats (rocky shores)

²Natural processes in respect of the SPA

The meaning of 'natural processes' is explained in **section 4.1.1**.

³Key intertidal invertebrate prey species of the waterfowl assemblage

eg *Arenicola*, *Carcinus*, *Corophium*, *Crangon*, *Gammarus*, *Hydrobia*, *Macoma*, *Hediste*, *Notomastus* and *Talitrus* spp. - these lists are examples and are not exhaustive

⁴Key saltmarsh food plants

eg *Puccinellia maritima*, *Salicornia* spp., *Agrostis stolonifera*, *Atriplex* spp., *Hordeum marinum*, *Festuca rubra*, *Alopecurus bulbosus*, *Lolium perenne* - these lists are examples and are not exhaustive

4.2.8 Favourable Condition Tables for SPA interest features of the Severn Estuary European Marine Site

Background information on the role of favourable condition tables and the information provided in each column is provided in section 1.8 of this document, and a concise glossary of terms used is provided in Section 7.

The favourable condition table is intended to supplement the conservation objectives, including with respect to the management of established and ongoing activities, future requirements of monitoring and reporting on the condition of the features of the site and, together with the conservation objectives, informs the scope and nature of any appropriate assessment that may be needed. The table **does not by itself** provide a comprehensive basis on which to assess plans and projects as required under the Habitats Regulations. It should be noted that appropriate assessments are a separate activity to condition monitoring, requiring consideration of issues specific to individual plans or projects.

These tables set out all the attributes that **may** be used to monitor the condition of the features of the SPA. Where possible we will seek available information from others which can inform our assessment process.

It will be possible to monitor many of the attributes at the same time or during the same survey. The frequency of sampling for many attributes may need to be greater during the initial monitoring events in order to characterise the site and establish the baselines. Extreme events (such as storms reducing or increasing salinities, exceptionally cold winters or warm summers) also need to be recorded as they may be critical in influencing ecological issues in the Severn Estuary and may well be missed by routine monitoring.

Comprising :

Table 15 – Favourable condition table for the supporting habitats of the bird interest features in the Severn Estuary SPA

Table 16 – Favourable condition table for the qualifying bird features of the Severn Estuary SPA

Reference should also be made to Tables 8,10 and 11 - Favourable Condition Tables for the SAC habitat features relevant to the supporting habitats (intertidal mudflats and sandflats, saltmarsh and hard substrate habitats (rocky shores)) .

Table 15 Favourable Condition Table for the supporting habitats of the bird interest features in the Severn Estuary SPA European Marine Site (information on the populations of bird species using these habitats are given in Table 4)

SPA interest feature	Supporting Habitat	Attribute	Measure	Target	Comments
<i>SPA interest feature 1: Internationally important Annex 1 species: Bewick's swan</i>	Saltmarsh	Habitat extent	Area (ha) measured once per reporting cycle.	At The Dumbles, no decrease in extent from 76 ha.	Saltmarsh provides an important feeding and roosting habitat for Bewick's swans on The Dumbles - saltmarsh/transition wet grassland in front of sea defences.
		Vegetation characteristics	Abundance of suitable soft leaved herbs and grasses - % cover (frequency to be determined)	Greater than 25% cover during the winter season.	Bewick's swans graze on soft wet meadow grasses such as <i>Agrostis stolonifera</i> , <i>Glyceria fluitans</i> and <i>Alopecurus geniculatus</i> which are found in the transition of saltmarsh to grassland.
		Unimpeded sightlines at feeding and roosting sites	Openness of terrain unrestricted by obstructions	No increase in obstructions to existing bird sightlines. Areas of vegetation with an effective field size of >6ha	Bewick's swan require unrestricted views >500m to allow early detection of predators when feeding and roosting.
	Intertidal mudflats and sandflats	Habitat extent	Area (ha), measured once per reporting cycle.	At Frampton Sands, Waveridge Sands and the Noose, no decrease in extent from 980 ha.	The intertidal mudflats and sandflats at The Noose, Frampton Sand and Waveridge Sand are used as disturbance refuge for Bewick's swan. The extent and distribution of this sub-feature are important to maintain the population in favourable condition.
		Unimpeded sightlines at feeding and roosting sites	Openness of terrain unrestricted by obstructions	No increase in obstructions to existing bird sightlines.	Bewick's swan require unrestricted views >500m to allow early detection of predators when feeding and roosting.

Table 15 - continued

SPA interest feature	Supporting Habitat	Attribute	Measure	Target	Comments
<i>SPA interest features 2 - 6:</i> Internationally important populations of regularly occurring migratory species and <i>SPA interest feature 7:</i> Internationally important assemblage of waterfowl	Saltmarsh	Habitat extent	Area (ha), measured once per reporting cycle.	No decrease in extent from 1,400 ha. At The Dumbles, no decrease in extent from 76 ha.	Saltmarsh and their communities are important habitats as they provide both roosting and feeding areas.
		Food availability	Presence and abundance of suitable saltmarsh food plants measured periodically (frequency to be determined).	Presence and abundance of suitable saltmarsh food plants should not deviate significantly from an established baseline ¹	European white-fronted geese graze on a range of saltmarsh grasses and herbs. Wigeon feed on well-grazed saltmarsh with <i>Puccinella maritiae</i> , <i>Salicornia</i> and <i>Agrostis</i> . Teal and pintail feed on seeds from <i>Salicornia</i> and <i>Atriplex</i> .
		Vegetation characteristics	Range of vegetation heights measured periodically (frequency to be determined).	Sward height and density throughout areas used for roosting should not deviate significantly from an established baseline ¹ .	Vegetation of <10 cm is required throughout areas used by roosting waders. This is managed by grazing.
		Unimpeded sightlines at feeding and roosting sites	Openness of terrain unrestricted by obstructions	No increase in obstructions to existing bird sightlines.	Waterfowl require unrestricted views >500m to allow early detection of predators when feeding and roosting.

Table 15 - continued

SPA interest feature	Supporting Habitat	Attribute	Measure	Target	Comments
<i>SPA interest features 2 - 6:</i> Internationally important populations of regularly occurring migratory species and <i>SPA interest feature 7:</i> Internationally important assemblage of waterfowl	Intertidal mudflats and sandflats	Habitat extent	Area (ha), measured once per reporting cycle.	No decrease in extent from 15,000 ha. At Frampton Sands, Waveridge Sands and The Noose no decrease in extent from 980 ha.	Intertidal mudflats and sandflats and their communities are important habitats as they provide both roosting and feeding areas.
		Food availability	Presence and abundance of suitable prey species measured periodically (frequency to be determined).	Presence and abundance of suitable prey species should not deviate significantly from an established baseline. ¹	Most of the waders and waterfowl within the assemblage including the internationally important regularly occurring migratory birds feed on invertebrates within and on the sediments. Diet includes <i>Arenicola</i> , <i>Crangon</i> , <i>Hydrobia</i> , <i>Hediste</i> , <i>Corophium</i> , <i>Macoma</i> , <i>Gammarus</i> , small molluscs and strandline plankton and seeds.
		Unimpeded sightlines at feeding and roosting sites	Openness of terrain unrestricted by obstructions	No increase in obstructions to existing bird sightlines.	Waterfowl require unrestricted views >500m to allow early detection of predators when feeding and roosting.
	Shingle and rocky shores	Habitat extent	Area (ha), measured once per reporting cycle.	No decrease in extent from 1,500 ha.	This habitat is used for feeding and roosting, particularly by waders.
		Food availability	Presence and abundance of suitable intertidal invertebrates, measured periodically (frequency to be determined).	Presence and abundance of suitable food species should not deviate significantly from an established baseline ¹	Waders feed on worms, crustaceans and molluscs.
		Unimpeded sightlines at feeding and roosting sites	Openness of terrain unrestricted by obstructions	No increase in obstructions to existing bird sightlines.	Waterfowl require unrestricted views >500m to allow early detection of predators when feeding and roosting.

¹ Baselines to be established

Table 16 Favourable Condition Table for the qualifying bird features in the Severn Estuary European Marine Site

SPA interest feature	Supporting Habitat	Attribute	Measure	Target	Comments
SPA interest feature 1: Internationally important Annex 1 species: Bewick's swan		Population size	5 year peak mean number of individuals	No less than 289 individuals [ie the 5 year peak mean between 1988/9 - 1992/3]	Mainly found in the Upper Severn Estuary at Slimbridge
		Proportion of biogeographic population	% of NW European population	1 % of NW European population	WeBS counts provide this information
		Distribution	Number and location of sectors occupied at low tide	No decrease in use of the number of sectors and their distribution established as baseline ¹	WeBS low tide counts display distribution information by sector (not annual counts) Birds use certain sectors to a greater or lesser degree from year to year
		Disturbance in feeding and roosting areas	Reduction or displacement of wintering birds	No significant reduction in numbers or displacement of wintering birds attributable to disturbance from an established baseline ¹	Significant disturbance attributable to human activities can result in reduced food intake and/or increased energy expenditure. Five year peak mean information on populations will be used as the basis for assessing whether disturbance is damaging.
SPA interest features 2 - 6: Internationally important populations of regularly occurring migratory species and SPA interest feature 7: Internationally important assemblage of waterfowl		Population size	5 year peak mean number of individuals	No less than 68,026 individuals in the assemblage [ie the 5 year peak mean between 1988/9 - 1992/3] For individual species - no less than the 5 year peak mean between 1988/9 - 1992/3 detailed in Table 4	Figures derived from WeBS counts. The 5 year peak means for this period for each of the internationally important populations and species with nationally important populations which make up the internationally important assemblage are detailed in Table 4
		Distribution	Number and location of sectors occupied at low tide	No decrease in use of the number of sectors and their distribution established as baseline ¹	In some years birds use certain sectors to a greater or lesser degree. WeBS low tide counts display distribution information by sector (not annual counts).

SPA interest feature	Supporting Habitat	Attribute	Measure	Target	Comments
		Disturbance in feeding and roosting areas.	Reduction or displacement of wintering birds	No significant reduction in numbers or displacement of wintering birds attributable to disturbance from an established baseline ¹ .	Significant disturbance attributable to human activities can result in reduced food intake and/or increased energy expenditure. Five year peak mean information on populations will be used as the basis for assessing whether disturbance is damaging.

¹ Baselines to be established

4.3 Conservation objectives for the Severn Estuary / Môr Hafren Ramsar Site

The protection and management of the Ramsar in accordance with Article 6 of the Habitats Directive, including in particular the consideration of plans and projects under Article 6(3) and 6(4), should be carried out in view of the conservation objectives in this section.

4.3.1 Ramsar interest feature 1: Estuaries

The conservation objective for the “estuaries” feature of the Severn Estuary Ramsar Site is to maintain the feature in favourable condition, as defined by the conservation objective for the SAC “estuaries” feature” (refer to section 4.1.1 and Table 8 of this document), in so far as these objectives are applicable to the area designated as Ramsar Site and as defined below.

4.3.1.1 Explanatory information for the Ramsar Site “estuaries” conservation objective

The area of the estuarine ecosystem designated as Ramsar Site is smaller than that of the SAC as it is restricted to the terrestrial and intertidal areas and excludes all subtidal areas. There are therefore aspects of the SAC “estuaries” conservation objective that are not applicable to the Ramsar Site “estuaries” feature. The following Table 17 identifies the limits and restrictions, if any, that apply in respect of the Ramsar Site. The table layout follows the numbering of the SAC “estuaries” objective conditions given in section 4.1.1.

Table 17 - Limits of the Ramsar “estuaries” feature

SAC “estuaries” objective conditions to be met	Limits, if any, of the Ramsar
i. the total extent of the estuary is maintained;	Limited to the lesser area of the Ramsar Site – excludes all subtidal areas - refer also to Appendix 2
ii. the characteristic physical form (tidal prism/cross sectional area) and flow (tidal regime) of the estuary is maintained;	These requirements are related to the estuary regime, structure and function at a whole ecosystem level
iii. the characteristic range and relative proportions of sediment sizes and sediment budget ³ within the site is maintained;	
iv. the extent, variety and spatial distribution of estuarine habitat communities within the site is maintained;	Within the Ramsar Site this is limited to the habitats listed as Ramsar “estuarine habitats communities” ¹ below
v. the extent, variety, spatial distribution and community composition of hard substrate habitats and their notable communities is maintained;	Within the Ramsar Site this is limited to the habitats listed as Ramsar “hard substrate communities” ² below
vi. the abundance of the notable estuarine species assemblages is maintained or increased;	Within the Ramsar Site this is limited to the species listed as Ramsar “notable estuarine species assemblages” ³ below
vii. the physico-chemical characteristics of the water column support the ecological objectives described above;	These requirements apply estuary wide at a whole ecosystem level
viii. Toxic contaminants in water column and sediment are below levels which would pose a risk to the ecological objectives described above.	

¹Ramsar “estuarine habitat communities”

- a. Intertidal mudflats and sandflats (refer also to maps in Appendices 4 and 4a)
 - Intertidal gravel and clean sands
 - Intertidal muddy sands
 - Intertidal muds

- b. Saltmarshes (equivalent to the Atlantic saltmeadows feature of the SAC) (refer also to maps in Appendices 5 and 5a)
- Low – mid marsh communities
 - Mid – upper marsh communities
 - Transitional high marsh communities
 - Pioneer marsh communities

²Ramsar “hard substrate communities”

These include all hard substrate (rocky shore) communities within the Ramsar Site boundary shown in the map in Appendix 7 which includes the following notable communities:

- *Sabellaria alveolata* reefs on sand-abraded eulittoral rock (MLR.Sab Salv) *
- *Hydroids, ephemeral seaweeds and Littorina littorea* in shallow eulittoral mixed substrata pools. (LR.RkpH)
- *Balanus crenatus* and *Tubularia indivisa* on extremely tide-swept circalittoral rock ECR.BS.BalTub)
- *Fucus serratus* and piddocks on lower eulittoral soft rock (MLR.Fser.Pid)
- *Mytilus edulis* and piddocks on eulittoral firm clay (MLR.MytPid)
- *Balanus crenatus*, *Halichondrea panicea* and *Alcyonidium diaphanum* on extremely tide-swept sheltered circalittoral rock (ECR.BalHpan) .
- *Sertularia cupressina* and *Hydrallmania falcate* on tide-swept sublittoral cobbles or pebbles in coarse sand (IGS.ScupHyd).
- *Corralina officinalis* and coralline crusts in shallow eulittoral rockpools (LR.Rkp.Cor)
- Eel grass (*Zostera*) beds
- Any other notable hard substrata communities that may be identified.

*Note : where this community is contiguous with the occurrence of subtidal *Sabellaria alveolata* reefs it forms part of the SAC reefs feature. Within the Ramsar it is regarded as a component of the hard substrates subfeature of the Ramsar estuaries feature .

³Ramsar “notable estuarine species assemblages”

- i. Assemblage of fish species:
- Migratory species
 - o River and Sea Lamprey and Twaité shad and Allis shad
 - o Sea trout, salmon, eel,
 - Estuarine species
 - o Species typically occurring and breeding in estuaries (Bird, 2008)
 - o Marine species occurring in large numbers in estuaries (Bird, 2008)
 - Marine species
 - o Predominantly marine species occurring infrequently in the Severn (Bird, 2008)
 - Freshwater species
 - o Species typically occurring and breeding in freshwater and recorded within the Severn (Bird, 2008)

- ii Assemblage of waterfowl species (refer also to section 4.3.9)

Internationally important populations of waterfowl comprising :

- Regularly occurring Annex 1 species - Bewicks’ swan
- Regularly occurring migratory species - European white-fronted goose, dunlin, redshank, shelduck, and gadwall

Internationally important assemblage of waterfowl comprising above species plus the following :

- Nationally important bird populations - wigeon, teal, pintail, pochard, tufted duck, ringed plover, grey plover, curlew, whimbrel and spotted redshank, lesser black-backed gull

- iii. Assemblage of vascular plant species:

- Salt marsh species (refer to notes 5 and 6 in section 4.1.4.1 - explanatory information on the conservation objective for the Atlantic salt meadows feature)
- Eel grass (*Zostera*) species.

4.3.2 Ramsar interest feature 2: Assemblage of migratory fish species¹

The conservation objective for the “assemblage of migratory fish species” feature of the Severn Estuary Ramsar Site is to maintain the feature in favourable condition, as defined below:

The feature will be considered to be in favourable condition when, subject to natural processes², each of the following conditions are met:

- i. the migratory passage of both adults and juveniles of the assemblage of migratory fish species through the Severn Estuary between the Bristol Channel and any of their spawning rivers is not obstructed or impeded by physical barriers, changes in flows, or poor water quality;
- ii. the size of the populations of the assemblage species in the Severn Estuary and the rivers which drain into it, is at least maintained and is at a level that is sustainable in the long term;
- iii. the abundance of prey species³ forming the principle food resources for the assemblage species within the estuary, is maintained.
- iv. Toxic contaminants in the water column⁴ and sediment are below levels which would pose a risk to the ecological objectives described above.

The meaning of terms ¹⁻⁴ above is explained in **section 4.3.2.1**

Note : The populations of three of the assemblage species (river lamprey, sea lamprey and twaite shad) are designated as features of the SAC for which separate specific objectives have been written (refer to sections 4.1.6 to 4.1.8 of this document). The populations of these species depend on habitat in the adjacent River Usk SAC, River Wye SAC and River Severn. The habitats in these rivers, including spawning and nursery areas, are essential for the fulfilment of the species’ lifecycle and therefore these features can only be in favourable condition if the conservation objectives pertaining to the River Usk SAC and River Wye SAC are also met in full and there is a continued recorded presence of these species in the River Severn.

4.3.2.1 Explanatory information for the assemblage of migratory fish species conservation objective

¹ Assemblage of migratory fish species

Species which are designated features of the SAC and for which individual conservation objectives have been written (refer to sections 4.1.6, 4.1.7 and 4.1.8)

Sea lamprey *Petromyzon marinus*
River lamprey *Lampetra fluviatilis*
Twaite shad *Alosa. fallax*

Other migratory species in the assemblage

Allis shad *Alosa alosa*
Salmon *Salmo salar*
Sea trout *S. trutta*
Eel *Anguilla anguilla*.

²Natural processes in respect of the Ramsar fish features

Assemblage populations :

The size of the populations is subject to non anthropogenic factors relating to natural fluctuations of external factors such as food / host availability in the Bristol Channel and more widely and breeding success in the River Severn and other rivers draining into the Severn Estuary.

Supporting habitats

The general meaning of ‘natural processes’ with respect to the supporting habitats of the migratory fish assemblage within the estuary is explained in **section 4.1.1.1**.

³Prey species

Assemblage Species	Key prey species
Sea lamprey	Eel <i>Anguilla anguilla</i> , cod <i>Gadus morhua</i> , and haddock <i>Melanogrammus aeglefinus</i> are all potential prey species for the sea lamprey found within the Severn Estuary (Bird 2008)
River lamprey	Sea trout <i>Salmo trutta</i> , shad <i>Alosa fallax/Alosa alosa</i> , herring <i>Clupea harengus</i> , sprat <i>Sprattus sprattus</i> , flounder <i>Platichthys flesus</i> and small gadoids such as whiting <i>Merlangius merlangus</i> and pout <i>Trisopterus luscus</i> are all potential prey species for the river lamprey found within the Severn Estuary (Bird 2008).
Twaite shad	Small crustaceans, especially mysids and copepods, small fish, especially sprats and anchovies, and fish eggs (Maitland, P.S. & Hatton-Ellis 2003).
Allis shad	Small crustaceans, especially mysids and copepods, small fish, especially sprats and anchovies, and fish eggs (Maitland, P.S. & Hatton-Ellis 2003).
Salmon	While at sea, salmon feed on a variety of fish (e.g. herring, sprat, sand eel, mackerel, and various gadoids) and crustaceans (e.g. euphausiid shrimps, prawns, gammarid amphipods and various crabs). (Bird, 2008)
Sea trout	The diet of this species at sea has not been much studied but is believed to include a range of fish species including sprat, young herring and sand eels as well as crustaceans such as amphipods (e.g. Corophium), gammarids, decapods such as Crangon and mysid shrimps. Many of these prey items also occur in estuaries where sea trout are known to feed extensively. (Bird, 2008)
Eel	A range of benthic organisms that include crustaceans and small fish. (Bird, 2008)

⁴Water column

Water column should be read to include contributory water flows into the estuary including surface flows over mudflats and saltmarsh.

4.3.3 Ramsar interest feature 3: Internationally important populations of waterfowl : Bewick's swan

The conservation objective for the “Bewick's swan” feature of the Severn Estuary Ramsar Site is to maintain the feature in favourable condition, as defined by the conservation objective for the SPA “Bewick's swan ” feature (refer to section 4.2.1)

4.3.4 Ramsar interest feature 4 : Internationally important populations of waterfowl : European white-fronted goose

The conservation objective for the “European white-fronted goose” feature of the Severn Estuary Ramsar Site is to maintain the feature in favourable condition, as defined by the conservation objective for the SPA “wintering European white-fronted goose” feature (refer to section 4.2.2)

4.3.5 Ramsar interest feature 5: Internationally important populations of waterfowl : dunlin

The conservation objective for the “dunlin” feature of the Severn Estuary Ramsar Site is to maintain the feature in favourable condition, as defined by the conservation objective for the SPA “wintering dunlin ” feature (refer to section 4.2.3)

4.3.6 Ramsar interest feature 6: Internationally important populations of waterfowl : redshank

The conservation objective for the “redshank” feature of the Severn Estuary Ramsar Site is to maintain the feature in favourable condition, as defined by the conservation objective for the SPA “wintering redshank” feature (refer to section sections 4.2.4)

4.3.7 Ramsar interest feature 7: Internationally important populations of waterfowl :shelduck

The conservation objective for the “shelduck” feature of the Severn Estuary Ramsar Site is to maintain the feature in favourable condition, as defined by the conservation objective for the SPA “wintering shelduck” feature (refer to section 4.2.5)

4.3.8 Ramsar interest feature 8: Internationally important populations of waterfowl : gadwall

The conservation objective for the “gadwall” feature of the Severn Estuary Ramsar Site is to maintain the feature in favourable condition, as defined by the conservation objective for the SPA “wintering gadwall” feature (refer to section sections 4.2.6)

4.3.9 Ramsar interest feature 9: Internationally important assemblage of waterfowl

The conservation objective for the “internationally important assemblage of waterfowl” feature of the Severn Estuary Ramsar Site is to maintain the feature in favourable condition, as defined by the conservation objective for the SPA “internationally important assemblage of waterfowl” feature (refer to section sections 4.2.7) – with special reference to the individual species listed and their population figures given in Table 6

Note : This Ramsar Site feature incorporates both wintering and passage populations of some birds and hence some species are included more than once in lists given in Table 6

4.3.10 Favourable Condition Tables for the Ramsar Site interest features of the Severn Estuary European Marine Site

Background information on the role of favourable condition tables and the information provided in each column is provided in section 1.8 of this document, and a concise glossary of terms used is provided in Section 7.

The favourable condition table is intended to supplement the conservation objectives, including with respect to the management of established and ongoing activities, future requirements of monitoring and reporting on the condition of the features of the site and, together with the conservation objectives, informs the scope and nature of any appropriate assessment that may be needed. The table **does not by itself** provide a comprehensive basis on which to assess plans and projects as required under the Habitats Regulations. It should be noted that appropriate assessments are a separate activity to condition monitoring, requiring consideration of issues specific to individual plans or projects.

These tables set out all the attributes that **may** be used to monitor the condition of the features of the Ramsar Site. Where possible we will seek available information from others which can inform our assessment process.

It will be possible to monitor many of the attributes at the same time or during the same survey. The frequency of sampling for many attributes may need to be greater during the initial monitoring events in order to characterise the site and establish the baselines. Extreme events (such as storms reducing or increasing salinities, exceptionally cold winters or warm summers) also need to be recorded as they may be critical in influencing ecological issues in the Severn Estuary and may well be missed by routine monitoring.

Comprising :

Table 18 – Favourable condition table for the “estuaries” feature of the Severn Estuary Ramsar Site

Table 19 – Favourable condition table for the migratory fish assemblage of the Severn Estuary Ramsar Site

Table 20 – Favourable condition table for the supporting habitats of the bird interest features (Ramsar features 3 to 9) in the Severn Estuary Ramsar Site

Table 21 – Favourable condition table for the qualifying bird interest features in the Severn Estuary Ramsar Site

Favourable condition table for the “estuaries” feature of the Severn Estuary Ramsar Site

Reference should also be made to Tables 8,10 and 11 - Favourable Condition Tables for the SAC habitat features relevant to the supporting habitats (intertidal mudflats and sandflats, saltmarsh and hard substrate habitats (rocky shores)) .

Table 18 Favourable Condition Table for the “estuaries” feature of the Severn Estuary Ramsar Site

Ramsar interest feature	Comments
<i>Ramsar Interest feature 1: Estuaries</i>	The Favourable Condition Table for the “estuaries” feature of the Severn Estuary Ramsar Site is largely the same as that for the Severn Estuary SAC “estuaries” feature (see section 4.1 : Table 8). However the area of the estuarine ecosystem designated as Ramsar Site is smaller than that of the SAC as it is restricted to the terrestrial and intertidal areas and excludes all subtidal areas. Table 17 identifies the limits and restrictions that apply in respect of the Ramsar Site Conservation Objective. There are therefore aspects of the SAC “estuaries” Favourable Condition Table that are not applicable to the Ramsar Site “estuaries” feature as follows : • All attributes other than those referred to below - apply only in respect of the area within the Ramsar Boundary (as shown in Appendix 2) • Line A6 - which relates to the subtidal sandbanks subfeature of the estuaries feature - this does not apply as these habitats lie outside the boundary of the Ramsar Site • Line A9 - which relates to the reefs subfeature of the estuaries feature - this only applies in respect of areas where intertidal <i>Sabellaria alveolata</i> occurs contiguously with the subtidal reefs (yet to be fully defined).

Table 19 Favourable Condition Table for the Migratory fish assemblage feature of the Severn Estuary Ramsar Site

Ramsar interest feature	Sub-feature	Attribute	Measure	Target	Comments
Ramsar Interest feature 2 : Migratory fish assemblage		Migratory access (Barriers to migration) (migratory passage not impeded - sections 4.6.i and 4.7.i of the conservation objectives)	Water quality measured regularly throughout the reporting cycle in the Bristol Channel, Severn Estuary, River Wye SAC, River Usk SAC and River Severn. (see also lines A17- A20 of Table 8 relating to general water quality requirements for the estuary feature (and dependant sub features)	Water quality is sufficient to support migratory passage. Levels (for temperature, salinity, turbidity and pH, and dissolved oxygen) should comply with targets established under the EA Review of Consents and the Water Framework Directive. Baseline is water quality sampling data collected by the Environment Agency	Significant variation in these physio-chemical parameters may act as barriers to migration. For example, the timing, duration and consistency of their upstream migration are believed to be closely related to temperature changes as well as pheromone triggers from the juveniles during periods of high water flow. Peak migration usually coincides with river temperatures that remain above 10°C and continues until temperatures reach 18°C. Dissolved oxygen can also be significantly reduced in stretches receiving significant BOD inputs, or through the re-suspension of organic rich sediments. Toxic contaminants may act as a barrier to migration.
			Water flows measured regularly throughout the reporting cycle (frequency to be determined) in the River Wye SAC, River Usk SAC and River Severn (see also line A3 of Table 8 relating to general tidal and water flow requirements for the estuary feature (and dependant sub features)	Flows from the rivers into the estuary must be sufficient to allow migration Baseline is water flow sampling data collected by the Environment Agency provides a baseline. Severe low flow conditions that affect these species yet to be defined	
			Physical barriers Mapping and quantification of potential obstructions in relation to height, type and water depth below obstruction once during the reporting cycle.	No artificial barriers significantly impairing, adults from reaching existing and historical spawning grounds, or juveniles from moving downstream. Baseline is the Environment Agency data on structures and flood defences	Dams, navigation and other weirs may prevent fish from reaching their spawning grounds. In particular, sea lamprey is known to be poor at ascending obstacles.

Ramsar interest feature	Sub-feature	Attribute	Measure	Target	Comments
		Population sizes (returning adults) <i>(size of populations - sections 4.6.ii and 4.7.ii of the conservation objectives)</i>	Number of returning adults measured using fish counters on the feeding rivers (Wye, Usk and Severn) during the migratory period.	No decline in number of returning adults from established baseline. <i>Baseline is yet to be established - fish counter data may be able to provide a baseline in future years.</i>	(Note that this attribute will not be able to be measured until the technological solutions for monitoring some species (notably lampreys and shad) are developed.)
		River populations <i>(size of populations - sections 4.6.ii and 4.7.ii of the conservation objectives)</i>	Survey through various methods (Electrofishing, seine netting, line fishing records, licencing returns) at a series of locations in the Rivers Wye, Usk and Severn	No decline in populations of the Rivers Wye and Usk <i>Baseline is yet to be established - fish counter data may be able to provide a baseline in future years.</i>	Details of methods for river and sea lamprey are outlined in section 4.1.9, Table 13 and for Twaite shad in Table 14 - the individual FCT for these species within the SAC section of this document
		Prey species <i>(abundance of prey species - sections 4.6.iii and 4.7.iii of the conservation objectives)</i>	The abundance of key prey species measured by EA in their routine monitoring of the rivers and estuary	No significant reduction in abundance of key prey species against an established baseline <i>Baseline is yet to be established through fish surveys in estuary and rivers</i>	River and sea lamprey require a variety of other fish species to act as hosts throughout their lifecycle. Their principal host species are part of the estuarine fish assemblage which has measures and targets included within Table 8. Twaite shad require a variety of invertebrates including crustacean, mysids and copepods, small fish and fish eggs particularly in that section of the estuary where saline and freshwaters meet. While at sea, salmon feed on a variety of fish (e.g. herring, sprat, sand eel, mackerel, and various gadoids) and crustaceans (e.g. euphausiid shrimps, prawns, gammarid amphipods and various crabs). (Bird, 2008) The diet of sea trout at sea is believed to include a range of fish species including sprat, young herring and sand eels as well as crustaceans such as amphipods (e.g. Corophium), gammarids, decapods such as Crangon and mysid shrimps. Eels feed on a range of benthic organisms that include crustaceans and small fish. (Bird, 2008)

Table 20 Favourable Condition Table for the supporting habitats of the bird interest features (Ramsar interest features 3 to 9) in the Severn Estuary Ramsar Site (Numbers of bird species using these habitats are given in Table 6)

Ramsar interest features	Supporting Habitat	Attribute	Measure	Target	Comments
Ramsar Interest features 3-8 : Internationally important populations of waterfowl and Ramsar Interest feature 9 : Internationally important assemblage of waterfowl	Saltmarsh	Habitat extent	Area (ha) measured once per reporting cycle.	No decrease in extent from 1,400 ha. At The Dumbles, no decrease in extent from 76 ha.	Saltmarsh and their communities are important habitats as they provide both roosting and feeding areas.
		Food availability	Presence and abundance of suitable saltmarsh food plants measured periodically (frequency to be determined).	Presence and abundance of suitable saltmarsh food plants should not deviate significantly from an established baseline ¹ .	European white-fronted geese graze on a range of saltmarsh grasses and herbs. Wigeon feed on well-grazed saltmarsh with <i>Puccinella maritiae</i> , <i>Salicornia</i> and <i>Agrostis</i> . Teal and pintail feed on seeds from <i>Salicornia</i> and <i>Atriplex</i> .
		Vegetation characteristics	Abundance of suitable soft leaved herbs and grasses - % cover (frequency to be determined)	Greater than 25% cover during the winter season.	Bewick's swans graze on soft wet meadow grasses such as <i>Agrostis stolonifera</i> , <i>Glyceria fluitans</i> and <i>Alopecurus geniculatus</i> which are found in the transition of saltmarsh to grassland.
		Vegetation characteristics	Range of vegetation heights measured periodically (frequency to be determined).	Sward height and density throughout areas used for roosting should not deviate significantly from an established baseline ¹ .	Vegetation of <10 cm is required throughout areas used by roosting waders. This is managed by grazing.
		Unimpeded sightlines at feeding and roosting sites	Openness of terrain unrestricted by obstructions	No increase in obstructions to existing bird sightlines. Areas of vegetation with an effective field size of >6ha at the Dumbles (Bewicks swan)	Waterfowl require unrestricted views >500m to allow early detection of predators when feeding and roosting.

Table 20 continued

Ramsar interest features	Supporting Habitat	Attribute	Measure	Target	Comments
Ramsar Interest features 3-8 : Internationally important populations of waterfowl and Ramsar Interest feature 9 : Internationally important assemblage of waterfowl	Intertidal mudflats and sandflats	Habitat extent	Area (ha), measured once per reporting cycle.	No decrease in extent from 15,000 ha. At Frampton Sands, Waveridge Sands and The Noose no decrease in extent from 980 ha.	Intertidal mudflats and sandflats and their communities are important habitats as they provide both roosting and feeding areas. The intertidal mudflats and sandflats at The Noose, Frampton Sand and Waveridge Sand are used as disturbance refuge for Bewick's swan. The extent and distribution of this sub-feature are important to maintain the population in favourable condition.
		Food availability	Presence and abundance of suitable prey species measured periodically (frequency to be determined).	Presence and abundance of suitable prey species should not deviate significantly from an established baseline ¹ .	Most of the waders and waterfowl within the assemblage including the internationally important population of waterfowl feed on invertebrates within and on the sediments. Diet includes <i>Arenicola</i> , <i>Crangon</i> , <i>Hydrobia</i> , <i>Hediste</i> , <i>Corophium</i> , <i>Macoma</i> , <i>Gammarus</i> , small molluscs and strandline plankton and seeds.
		Unimpeded sightlines at feeding and roosting sites	Openness of terrain unrestricted by obstructions	No increase in obstructions to existing bird sightlines.	Waterfowl require unrestricted views >500m to allow early detection of predators when feeding and roosting.
	Shingle and rocky shores	Habitat extent	Area (ha), measured once per reporting cycle.	No decrease in extent from 1,500 ha.	This habitat is used for feeding and roosting, particularly by waders.
		Food availability	Presence and abundance of suitable intertidal invertebrates, measured periodically (frequency to be determined).	Presence and abundance of suitable food species should not deviate significantly from an established baseline ¹ .	Waders feed on worms, crustaceans and molluscs.
		Unimpeded sightlines at feeding and roosting sites	Openness of terrain unrestricted by obstructions	No increase in obstructions to existing bird sightlines.	Waterfowl require unrestricted views >500m to allow early detection of predators when feeding and roosting.

¹ Baselines to be established

Table 21 Favourable Condition Table for the qualifying bird features in the Severn Estuary Ramsar Site

Ramsar interest features	Supporting Habitat	Attribute	Measure	Target	Comments
<i>Ramsar Interest features 3-8 :</i> Internationally important populations of waterfowl and <i>Ramsar Interest feature 9 :</i> Internationally important assemblage of waterfowl		Population size	5 year peak mean number of individuals	No less than 68,026 individuals in the assemblage [ie the 5 year peak mean between 1988/9 - 1992/3] For individual species - no less than the 5 year peak mean between 1988/9 - 1992/3 detailed in Table 6	Figures derived from WeBS counts. The 5 year peak means for this period for each of the internationally important populations and species with nationally important populations which make up the internationally important assemblage are detailed in Table 6
		Distribution	Number and location of sectors occupied at low tide	No decrease in use of the number of sectors and their distribution established as baseline ¹ .	WeBS low tide counts display distribution information by sector (not annual counts) Birds use certain sectors to a greater or lesser degree from year to year
		Disturbance in feeding and roosting areas.	Reduction or displacement of wintering birds	No significant reduction in numbers or displacement of wintering birds attributable to disturbance from an established baseline ¹ .	Significant disturbance attributable to human activities can result in reduced food intake and/or increased energy expenditure. Five year peak mean information on populations will be used as the basis for assessing whether disturbance is damaging.

¹ Baselines to be established

5. Advice on Operations

CCW and Natural England have a duty under Regulation 33(2)(b) of The Conservation (Natural Habitats &c.) Regulations 1994 to advise other relevant authorities as to any operations which may cause deterioration of natural habitats or the habitats of species, or disturbance of species, for which the site has been designated. Information on how CCW and Natural England have developed this advice is given in section 5.2, and on how it may be reviewed and updated in the future in section 5.3.

The Advice on Operations concerning the SAC are provided in detail in Table 22 and section 5.6. The Advice on Operations concerning the SPA is provided in Table 23 and section 5.7. These include recommendations regarding specific interest features and their supporting habitats. The Advice on Operations concerning the Ramsar Site is provided by cross reference to the subsections of the advice for the SAC and SPA which are relevant to the Ramsar Site interest features.

5.1. Purpose of advice

The aim of this advice is to provide CCW and Natural England's Advice on Operations as required by Regulation 33 (2)(b) for the Severn Estuary European Marine Site and thereby enable all relevant authorities to direct and prioritise their work on the management of activities that pose the greatest potential threat to the favourable condition of interest features on the Severn Estuary European Marine Site. The advice should be read in conjunction with the Conservation Objectives for the SAC, SPA and Ramsar Sites interest features given in sections 4.1, 4.2 and 4.3 respectively and it is intended to provide the basis for detailed discussions to formulate and agree a management scheme for the European Marine Sites.

General advice on sensitivity, exposure (and therefore vulnerability) contained within this document is presented against broad categories of operation which may cause the deterioration of natural habitats or the habitats of species, or the disturbance of species (refer to section 5.2). It reflects activities and plans and projects. Generic examples of some of the types of operation that are covered under the broad category headings are given for illustration.

The advice is based on best available information at the time of preparation of the Regulation 33 advice for the Severn Estuary in 2008/09. For a current assessment of levels of disturbance of specific types of activity across the Severn Estuary (relevant solely to the SPA interest features), reference should be made to the SPA Scheme of Management, available at the ASERA website (<http://www.severnestuary.net/asera/>). It should be noted, however, that the frequency, intensity, effects and level of risk to the SPA features that certain activities may have are still being investigated under the existing Severn Estuary Scheme of Management.

5.2 Methods for assessment

The advice provided here is within six broad categories of operation which may cause the deterioration of natural habitats or the habitats of species, or the disturbance of species. These categories are:

- Physical loss
- Physical damage
- Non-physical disturbance
- Toxic contamination
- Non-toxic contamination
- Biological disturbance

Within these categories are environmental impacts that may result from operations. Example sources of activities are provided in the MarLIN *Maritime and coastal activities to environmental factors matrix* (see Appendix 10), although these are by no means inclusive of all potentially damaging activities.

Given current knowledge of the nature and extent of activities taking place within the Severn Estuary European Marine Site, this approach therefore:

- enables links to be made between human activities and the ecological requirements of the habitats or species, as required under Article 6 of the Habitats Directive;
- provides a consistent framework to enable relevant authorities in England and Wales to assess the effects of activities and identify priorities for management within their areas of responsibility; and
- is appropriately robust to take into account the development of novel activities or operations which may cause deterioration or disturbance to the interest features of the site and should have sufficient stability to need only infrequent review and updating by the CCW and Natural England.

These broad categories provide a clear framework against which relevant authorities can assess activities or operations under their responsibility. The more detailed information in Tables 22 and 23 (covering both the SAC and SPA) provides competent authorities with a context against which to consider an assessment of ‘significant effect’ of any plans or projects which may affect the site and a basis to inform on the scope and nature of appropriate assessments required in relation to plans and projects. It is important to note that this advice is only a starting point for assessing impacts. It does not remove the need for the relevant or competent authorities to consult CCW or Natural England formally over individual plans and projects where required to do so under the Regulations.

This Advice on Operations for the site is based on a three-step process involving:

- an assessment of the **sensitivity** of the interest features or their component supporting habitats to operations;
- an assessment of the **current exposure** of each interest feature or their component supporting habitats to operations; and
- a final assessment of **current vulnerability** of interest features or their component supporting habitats to operations.

Note that in respect of the SPA, sensitivity, exposure and vulnerability have been assessed largely in relation to the use of habitats by birds, but may also take into account direct effects on the bird species themselves (such as ‘shooting’ or ‘disturbance’).

This three-step process builds up a level of information necessary to manage activities in and around the European Marine Site in an effective manner and to identify to competent and relevant authorities those operations which pose the most immediate threats to the favourable condition of the interest features of the European Marine Site.

The assessment of relative sensitivity, exposure and vulnerability is derived using best available scientific information and informed scientific interpretation and judgement. The process uses sufficiently coarse categorisation to minimise uncertainty in information, reflecting the current state of knowledge and understanding of the marine environment. Where possible, the sensitivity, exposure and vulnerability are assessed on a three-point scale of ‘Low’, ‘Moderate’ or ‘High’. To assist with interpretation, these levels have been colour-coded in Tables 22 & 23.

5.2.1 Sensitivity assessment

The sensitivity assessment used is an assessment of the relative sensitivity of the interest features or the component supporting habitats of the Severn Estuary European Marine Site to the effects of six broad categories of human activities. In relation to this assessment, **sensitivity** has been defined as ‘**the intolerance of a habitat, community or individual (or individual colony) of a species to damage, or death, from an external factor and the time taken for its subsequent recovery**’ (MarLIN, 2003). For

example, a very sensitive species or habitat is one that is very adversely affected by an external factor arising from human activities or natural events (killed/destroyed, ‘high’ intolerance) and is expected to recover over a very long period of time, i.e. >10 or up to 25 years (‘low’ recoverability).

The sensitivity assessments are based on current information but may develop with improvements in scientific knowledge and understanding. The sensitivity of interest features (and scientific understanding of sensitivity) may change over time; hence an operation which is not currently considered to have a negative effect, may do so in the future.

English Nature (now Natural England) and Scottish Natural Heritage commissioned the Marine Biological Association of the UK, through its Marine Life Information Network (MarLIN) to provide detailed sensitivity information to underpin this advice. Detailed sensitivity information at a biotope or species level is available via MarLIN’s website (www.marlin.ac.uk). The sensitivity assessments are indicative qualitative judgements based on the best available scientific information. They represent the most likely (probable) result of a given change in a factor. The sensitivity assessments of the interest features or their component supporting habitats of the Severn Estuary SAC, SPA and Ramsar Site are based upon MarLIN sensitivity assessments for biotopes (components of the Annex I habitats) and species supplemented by local knowledge and professional judgement to provide a site specific assessment that reflect the unusual and extreme character of the Severn Estuary.

The sensitivities of each of the SAC Annex I habitat features have been assessed on the component biotopes represented within each of the habitats (where information is available). Where information has not been available, such as for subtidal *Sabellaria alveolata* reefs or for Atlantic saltmeadow communities, a number of scientific review documents have been consulted, including reports produced for the UK Marine SAC LIFE project (see Bibliography section for a full list of these).

Assessments for the Annex II migratory fish have been based on current knowledge (best available scientific knowledge), which is limited for the life phase that shad and lamprey spend in estuarine waters. Given the paucity of information, it has not been possible to assess the level of sensitivity on a three-point scale; they have been assessed to be either ‘sensitive’ or ‘not sensitive’.

For the SPA, the sensitivities have been assessed in relation to the use of habitats by birds and the sensitivities of the individual species themselves to certain activities. For example, wintering birds are highly sensitive to the loss of their roosting or feeding grounds; and they are highly sensitive to the noise of shooting. The sensitivity assessments of the interest features or their component supporting habitats of the Severn Estuary SPA are based on a number of scientific review documents. These include reports produced for the UK Marine SAC LIFE project (Davison & Hughes 1998; Elliott *et al.*, 1998), the Countryside Council for Wales Science Report (Holt *et al.*, 1995) and the Marine Habitats Review (Jones *et al.*, 2000.).

The magnitude or scale of the effect of an activity and the resultant change in environmental factors are site specific. For the purpose of this advice, the assessments of sensitivity have been adjusted for *changes in suspended sediments* and *turbidity* to reflect the particular conditions affecting the site. As a result of the high tidal energy of the site, the concentration of suspended sediment and turbidity are naturally very high. The marine fauna, including the migratory fish, are adapted to such high concentrations of suspended sediment and thus they are unlikely to have any significant effect. Consequently the sensitivities relating to *changes in suspended sediments* and *turbidity* have been downgraded.

Table 22 shows the sensitivity assessments for the SAC features and sensitivity assessments for the SPA can be seen in Table 23.

5.2.2 Exposure assessment

Exposure assessment has been undertaken for the Severn Estuary European Marine Site by assessing the relative exposure of the interest features or their component supporting habitats to the effects of broad categories of operations, resulting from human activities currently occurring on the site. Exposure has been assessed against a matrix which relates activities to operation pressures (see Appendix 10). The

matrix has been used as a guide and interpreted to assess the exposure to current activities known to be present within the site.

In assigning a three-point score (High, Moderate or Low) to the exposure, each activity is considered for:

- Spatial extent of the pressure
- Frequency of the pressure and
- Intensity of the pressure

For the SPA, the exposure has been assessed in relation to the use of habitats by birds and on the bird species themselves. As an example, the feeding and roosting grounds of wintering birds may be considered highly exposed to toxic contamination from synthetic compounds due to the locations and intensity of discharges into an area.

5.2.3 Vulnerability assessment

The third step in the process is to determine the vulnerability of interest features or their component supporting habitats to operations. This category results from an integration of sensitivity and exposure. Only if a feature is both sensitive and exposed to a human activity will it be considered vulnerable. In this context therefore, 'vulnerability' has been defined as **'the exposure of a habitat, community or individual (or individual colony) of a species to an external factor to which it is sensitive'** (Hiscock, 1996).

Tables 22 and 23 show the vulnerability assessments for the SAC features and the SPA features respectively.

5.3 Update and review of advice

Information as to the categories of operations which may cause the deterioration of natural habitats or the habitats or disturbance of species for which the site has been designated, is provided in light of what CCW and Natural England know about current activities and patterns of usage within the Severn Estuary European Marine Site. The general information on current activities and patterns of usage (which was used in part to derive Table 23) has been refined at the local level in producing the management scheme for the SPA and through further discussion with the relevant authorities. This management scheme is available at the ASERA website (<http://www.severnestuary.net/asera/>) although this will require review following this more detailed analysis of impacts on the estuarine habitats that are supporting habitats for the birds of the SPA.

The information provided in this advice on the sensitivity of interest features or their supporting habitats (Table 23) will change as a result of an improvement in our scientific knowledge, which will be a relatively long term process. It is suggested that advice for sites be kept under review and is periodically updated through discussion with relevant authorities and others to reflect significant changes in our understanding of sensitivity together with the potential effects of plans and projects on the marine environment.

5.4 Plans and Projects

Under Regulation 48(1), an appropriate assessment must be undertaken by competent authorities in respect of any plan or project which:

- a. either alone or in combination with other plans or projects is likely to have a **significant effect** on a European site; and
- b. is not directly connected with or necessary to the management of the site for nature conservation.

This legal requirement applies to all European sites (SACs and SPAs). Regulation 48 is also applied, as a matter of Government policy, to proposed SPAs and listed Ramsar sites.

Tables 22 and 23 provides competent authorities with a guide against which to initiate an assessment of the 'significance' of any plans or projects (and on-going operations or activities) proposed for the site, although this will only be a starting point for assessing impacts and does not remove the need for competent authorities to consult CCW or Natural England formally over individual plans and projects where required under the Regulations.

5.5 Review of consents

Regulation 50 of the Conservation (Natural Habitats, &c.) Regulations 1994 requires a competent authority to undertake a review of any existing consent or permission to which Regulation 48(1) would apply if it were to be reconsidered as of the date on which the site became a European site. Where a review is required under these provisions it must be carried out as soon as reasonably practicable after classification of the European Marine Site. Consents will need to be reviewed in the light of these objectives.

5.6 Specific Advice on Operations for the Severn Estuary SAC

This section provides information to help relate general advice to each of the specific interest features of the Severn Estuary SAC. Where specific examples are given they are provided to aid understanding of possible impacts and are not intended to be a comprehensive list of all relevant operations.

This advice relates to the vulnerability of the interest features and supporting habitats of the Severn Estuary SAC as set out in more detail in Table 22. A brief explanation of the sensitivity of the interest features or supporting habitats follows, with an explanation of their exposure and consequently their vulnerability to damage or disturbance from the listed categories of operations is also given. This enables links between the categories of operation and the ecological requirements of the European Marine Site and Ramsar Site interest features to be made.

The precise impact of any category of operation occurring on the site will be dependent upon the nature, scale, location and timing of events. In accordance with Government policy guidance, the Advice on Operations provided here, is feature and site specific, and provided in the light of current activities and patterns of usage at the site.

As such, it is important that future consideration of this advice by relevant authorities, and others, takes account of changes in usage patterns that have occurred at the site over the intervening period. Advice for sites should be kept under review: it is suggested that periodic discussions with relevant authorities and others be undertaken to reflect significant changes in the understanding of sensitivities, as well as the potential effects of future plans or projects on the marine environment.

5.6.1 Estuaries feature

(Note : this advice is also relevant to the “estuaries” feature of the Ramsar Site – refer also to section 5.8)

5.6.1.1 Sensitivity

The **estuary** and its associated biological communities are **moderately to highly sensitive** to:

- **physical loss**
- **physical damage**
- **toxic contamination**
- **non-toxic contamination** and
- **biological disturbance**

These result from a range of activities known to occur in the estuary. Further details are provided in points i) to xiv) below, with details of the level of sensitivity set out in Table 22.

5.6.1.2 Exposure

The **estuary** and its associated biological communities are **moderately to highly exposed** to:

- **substratum loss**
- **smothering**
- **changes in suspended sediment**
- **changes in water flow rate**
- **changes in wave exposure**
- **abrasion and physical disturbance**
- **noise and visual disturbance**
- **toxic contamination (introduction of synthetic & non synthetic compounds)**
- **changes in nutrient loading**
- **changes in thermal regime**
- **changes in turbidity**
- **changes in salinity**
- **changes in oxygenation**
- **introduction of microbial pathogens**
- **introduction of non-native species**
- **selective extraction of species**

5.6.1.3 Vulnerability

The **estuary** and its associated biological communities are **moderately to highly vulnerable** to:

i. Substratum loss

The estuary feature is considered to have **high sensitivity** and **high exposure** and therefore **high vulnerability** to substratum loss.

The physical loss of areas of intertidal habitats may be caused directly through a change in land use, or indirectly as a consequence of changes to sedimentation processes (e.g. resulting from the construction of groynes or of seawalls). Subtidal sedimentary habitats will be directly affected by the removal of material during maintenance dredging and aggregate extraction in particular. These activities, coupled with strong current flows, result in material being suspended in the water column and removed away from their point of origin. Removal of the substratum will lead to partial loss of faunal diversity, exposure of the underlying sediment and changes in the topography of the area. Intertidal seagrass beds will be adversely affected by substratum loss, with recoverability depending upon recruitment from other populations.

ii. Smothering

The estuary feature is considered to have **high sensitivity** and **moderate exposure** and therefore **high vulnerability** to smothering

Smothering of organisms is likely to occur as a result of the direct deposition of material on top of them and/or on their habitat. Examples of activities causing smothering in intertidal areas include beach replenishment, port developments, archaeological activities, coastal farming, industrial effluent discharge, oil spills, land runoff including highways discharge and sewage discharge. In subtidal areas, dumping of spoil from dredging operations is responsible for most smothering events. Both intertidal and subtidal seagrass beds are considered to be highly sensitive to smothering. A seagrass bed close to the second Severn crossing is known to have been adversely affected by smothering as a result of changes to sediment movements due to temporary works associated with the bridge construction in the early 1990's.

iii. Changes in suspended sediment

The estuary feature is considered to have **moderate sensitivity** and **moderate exposure** and therefore **moderate vulnerability** to changes in suspended sediment

As a result of the high tidal energy of the site, the concentration of suspended sediment and turbidity are naturally very high. This high tidal energy is one of the reasons for site selection as part of the Natura 2000 series. The marine fauna, including the migratory fish, are adapted to high concentrations of suspended sediment. Increase in sediment in suspension is unlikely to cause problems unless it leads to smothering (see smothering). Of greater concern in the Severn estuary would be the decrease in suspended sediments leading to increased light penetration and changes in the habitats and their plant and animal communities.

Activities likely to result in changes in suspended sediment would include those which would affect sediment availability or the water flow rate (coastal defences, development, construction and dredging).

iv. Changes in water flow rate

The estuary feature is currently considered to have **moderate sensitivity** and **high exposure** and therefore **high vulnerability** to changes in water flow rate.

The estuary is considered to have high exposure due to its highly constrained nature (by man made hard defences). Increases or decreases to the water flow rate are likely to lead to, respectively, increased sediment erosion or accretion in certain areas. Seagrass beds in particular are intolerant to any activity that changes the sediment regime. Activities/structures responsible for changing the water flow rate could include in-estuary construction; groynes, beach replenishment, sea walls/breakwaters, port developments and aggregate extraction.

v. Changes in wave exposure

The estuary feature is currently considered to have **high sensitivity** and **high exposure** and therefore **high vulnerability** to changes in wave exposure.

The estuary is considered to have high exposure due to its highly constrained nature (coastal defence structures; groynes, seawalls, breakwaters and beach replenishment) and presence of significant aggregate extraction which can cause changes in wave exposure. Storms and intense wave action may move or remove substrata from shallow subtidal sandbanks. Increased wave action will disrupt feeding and burrowing, and reduce species abundance, richness and biomass. Decreased wave exposure will result in increased food availability, but suspension feeders are intolerant of sediment increases in silt/clay content and therefore the proportion of suspension feeders may decrease in favour of deposit feeders. Both intertidal and subtidal seagrass beds are highly sensitive to changes in wave exposure, with an increase leading to loss of substrata and exposure of rhizomes, and a decrease causing deposition of fine particles on leaves which may result in smothering.

vi. Abrasion and physical disturbance

The estuary feature is currently considered to have **moderate sensitivity** and **high exposure** and therefore **high vulnerability** to physical disturbance and abrasion.

This factor includes mechanical interference, crushing, trampling, rubbing or erosion of the organism or habitat of interest. The activities most likely to cause abrasion include beach replenishment, development of port facilities, maintenance dredging, aggregate extraction, fixed netting, benthic trawls, sea-based recreation (including anchoring, power boat and jet ski wash), archaeology, coastal farming, educational visits, shipping, litter and debris. Habitats/communities that are moderately sensitive to abrasion include saltmarsh - see section 4.4 (at risk from overgrazing, erosion from moored boats or from trampling or vehicles), intertidal mudflats and sandflats (see section 4.3), and seagrass beds in particular.

vii. Toxic contamination

The estuary feature is currently considered to have **moderate sensitivity** and **high exposure** and therefore **high vulnerability** to toxic contamination. (Note that there is currently insufficient scientific information on the sensitivities of the estuarine habitats to radionuclides to determine any vulnerability).

This category includes contamination from synthetic compounds (including pesticides and herbicides), non-synthetic compounds (including heavy metals) and hydrocarbons (oil related products). As a result of the predominance of physical conditions within the Estuary, for the majority of biological communities there is little unequivocal evidence of additional impact due to contaminants across the Estuary as a whole. Individual populations may have been impacted close to major discharges however.

A number of synthetic compounds may be present locally in elevated concentrations. Riverine inputs are probably responsible for the majority of these compounds entering the Estuary. The concentration of metals in sediments (cadmium, arsenic, chromium, silver, copper, zinc and nickel in particular) are commonly above interim sediment quality guidelines over much of the Estuary, but only occasionally exceed probable effects levels (Langston et al., 2003). Bioaccumulation of metals occurs widely in invertebrates, though the ecological significance is still uncertain. Hydrocarbon compounds may also be present locally in elevated concentrations. Sources include a combination of fossil fuel combustion, shipping, urban run-off, sewage treatment works and various point-source and diffuse discharges from industrialised areas. Moderately high levels of poly-aromatic hydrocarbons (PAHs) are present in sediments across much of the Estuary. Overall vulnerability to all toxic contamination is considered 'high' (due to the exposure from sewage inputs being classed as 'high' and also with 'moderate' levels from industrial inputs etc.).

Note that there is currently insufficient scientific information on the sensitivities of the estuarine habitats to radionuclides to determine any vulnerability. However despite the presence of several potential sources of radionuclides (Berkeley, Oldbury and Hinkley Nuclear Power Plants, a manufacturer of radiopharmaceuticals in Cardiff and a number of other smaller sources) the accumulation of radionuclides in the Severn Estuary is generally low compared with samples from the Irish Sea. The exceptions to this are Tritium and Carbon 14, which have been found locally at significant levels. This is thought to be related to discharges from the radiopharmaceutical company in Cardiff, for which remedial action is being taken. (Langston et al, 2003).

viii. Changes in nutrient loading

The estuary feature is considered to have **high sensitivity** and **high exposure** to changes in nutrient loading but **is not considered vulnerable to changes in nutrient loading due to the high natural turbidity**.

Whilst nutrient levels and loadings within the Estuary are considered significant in UK terms (and thus have been scored as high for sensitivity and high for exposure), the high natural turbidity of the system negates these high levels, with algal productivity being generally low except in localised hotspots. Where these do occur, nutrient enrichment may lead to significant shifts in community composition on/in subtidal sandbanks (see section 5.2) and on/in intertidal mudflats and sandflats (see section 5.3), but recoverability is likely to be high. Should there be a decrease in natural turbidity levels, then the overall associated 'masking effect' would be lessened and there would be a higher risk of nutrient enrichment.

At the present time, despite the high sensitivity and high exposure scores discussed above, the high natural turbidity levels across most of the estuary lead to a conclusion that the estuary is not considered vulnerable to changes in nutrient loading.

ix. Changes in thermal regime

The estuary feature is considered to have **moderate sensitivity** and **moderate exposure** and therefore **moderate vulnerability** to changes in thermal regime

Temperature can affect many biological, physical and chemical geochemical processes within the water column including stratification, mixing and turbidity, nutrients, oxygenation, salinity and pH. For example, activities which can cause short or longterm changes in temperature can include thermal discharges (eg from power station cooling waters and other discharges). Thermal discharges are likely to be between 2 and 10 degrees above ambient temperature and a long term duration of changes may impact on the larval forms and breeding cycles of marine organisms.

x. Changes in salinity

The estuary feature is considered to have **moderate sensitivity** and **high exposure** and therefore **high vulnerability** to changes in salinity.

Decreases in salinity within the Estuary are likely to result from heavy rain events and associated land/waterfront run-off and riverine inputs. The vast floodplain and catchment area of the Severn Estuary results in annual extreme flooding events and prolonged periods of freshwater input the estuary so the exposure is considered to be high. Localised salinity changes may also result around discharges. Certain biotopes associated with subtidal sandbanks occur in conditions of reduced salinity and these biotopes are considered to be moderately vulnerable to any long-term increases in salinity levels.

xi. Changes in oxygenation

The estuary feature is currently considered to have **moderate sensitivity** and **high exposure** and therefore **high vulnerability** to changes in oxygenation.

A cycle of changes in oxygenation occurs within the Severn as a result of both seasonal and tidal cycles and is linked to fluctuating sediment regimes. In addition occasional, intermittent oxygen sags occur in low salinity regions of the Severn and in some of the principal rivers feeding the Estuary. These probably originate from high densities of suspended solids and associated particulate organic matter, perhaps enhanced by discharge outfalls. Other causes include maintenance dredging, aggregate extraction, spoil dumping, coastal farming and shipping.

Oxygen-deficient marine areas are characterized by a decline in the number and diversity of species. Certain communities occurring within the Estuary's intertidal mudflats and sandflats are moderately sensitive to decreases in dissolved oxygen levels. However, recoverability of these areas should be rapid upon return to normal conditions. The fish assemblage is also likely to be sensitive to decreases in dissolved oxygen levels, although it is unclear what the level of sensitivity is at the present time.

xii. Introduction of microbial pathogens

The estuary feature is currently considered to have **high sensitivity** and **high exposure** and therefore **high vulnerability** to changes in microbial pathogens.

Microbial pathogens are most likely to enter the Severn's ecosystem by means of sewage discharges, be these from port facilities, recreational boating, shipping or the outfalls from sewage treatment works. For the majority of biological communities there is insufficient information available to be able to make an assessment of their sensitivity to microbial pathogens. Of the few known impacts, subtidal seagrass beds of *Zostera marina* are known to be highly sensitive to the marine fungus *Labyrinthula macrocystis* which causes 'wasting disease'. The disease causes the death of leaves and, after 2-3 seasons, can lead to the death of regenerative shoots, rhizomes and the loss of up to 90% of the population and its associated

biotope. However, no information has been found which confirms the presence of the wasting disease in the Estuary.

While no information has been found which confirms the presence of the wasting disease in the estuary, the potential significant consequences for one of this notable estuarine community in particular has led to the conclusion that estuary is highly sensitive to microbial pathogens. The exposure is considered to be high due to the high number of sewage discharges.

xiii. Introduction of non-native species

The estuary feature is currently considered to have **high sensitivity** and **moderate exposure** and therefore **high vulnerability** to the introduction of non-native species.

The saltmarsh cordgrass *Spartina anglica* is an invasive pioneer species whose rapid growth consolidates sediment, raises mudflats and reduces sediment availability elsewhere. It is regarded as being a potential threat to intertidal beds of *Zostera noltei* in particular. However, whilst recognising *S. anglica* as an invasive species, it also has a role in saltmarsh formation and the community SM6 in which it features should be allowed to develop into other Atlantic Salt Meadow or transitional communities. The Japanese seaweed *Sargassum muticum* is another non-native species which is thought to compete for space with the subtidal seagrass *Zostera marina*, though evidence for actual competition is conflicting. The presence of another non-native, the slipper limpet *Crepidula fornicata*, in large numbers may alter the species composition within certain soft mud habitats leading to a decline in overall species richness. However, *C. fornicata* has yet to penetrate the Estuary, possibly due to the strong water flows. The exposure to introduction of non-natives to the estuary is considered to be moderate because of the considerable volume of ship traffic, including transport to and from the major ports at Cardiff, Newport and Bristol.

xiv. Selective extraction of species

The estuary feature is currently considered to have **moderate sensitivity** and **high exposure** and therefore **high vulnerability** to the selective extraction of species.

This category refers to the removal of key species within a biotope or of a prey species. Activities which occur within the Estuary which are likely to be implicated bait digging, fixed netting, commercial fishing, recreational angling, wildfowling and educational visits. Whilst the majority of biotopes have a low sensitivity to such activities, intertidal *Zostera noltei* beds are highly sensitive to grazing by species of wildfowl. Significant amounts of dwarf eelgrass can be consumed by wildfowl, particularly during the autumn and winter months. However as these grazers are also part of the natural estuarine ecosystem and designated features in their own right their impact is not judged to be detrimental.

5.6.2 Subtidal sandbanks feature

5.6.2.1 Sensitivity

The **sandbanks** and their associated biological communities are **moderately to highly sensitive** to:

- **physical loss**
- **physical damage**
- **toxic contamination**
- **non-toxic contamination**
- **biological disturbance**

These result from a range of activities known to occur in the vicinity of the sandbanks. Further details are provided in points i) to vii) below, with details of the level of sensitivity set out in Table 22.

5.6.2.2 Exposure

The **sandbanks** and their associated biological communities are **moderately to highly exposed** to:

- **substratum loss**
- **smothering**
- **changes in suspended sediment**
- **abrasion and physical disturbance**
- **noise and visual disturbance**
- **toxic contamination (introduction of synthetic & non synthetic compounds)**
- **changes in nutrient loading**
- **changes in turbidity**
- **changes in salinity**
- **changes in oxygenation**
- **introduction of microbial pathogens**

5.6.2.3 Vulnerability

The subtidal sandbanks communities are **moderately to highly vulnerable** to:

i. Substratum loss

The subtidal sandbanks feature is currently considered to have **moderate sensitivity** and **moderate exposure** and therefore **moderate vulnerability** to substratum loss.

The physical loss of subtidal sandbanks will occur through the removal of material during maintenance dredging and aggregate extraction in particular. These activities, coupled with strong current flows, result in material being suspended in the water column and removed away from their point of origin. Removal of the substratum will lead to partial loss of faunal diversity, exposure of the underlying sediment and changes in the topography of the area. Recolonisation of the biotope might occur within a few months, but the biotope would be unlikely to be recognized until after six months. Cohesive mud and sandy mud communities are considered to be moderately sensitive to substratum loss.

ii. Changes in suspended sediment

The subtidal sandbanks feature is currently considered to have **moderate sensitivity** and **moderate exposure** and therefore **moderate vulnerability** to changes in suspended sediment.

Increase in sediment in suspension are unlikely to cause problems unless it leads to smothering (see smothering). A decrease in suspended sediments may lead to increased light penetration and changes in the sandbank communities.

Activities likely to result in changes in suspended sediment would include those which would affect sediment availability or the water flow rate (coastal defences, development, construction and dredging).

iii. Toxic contamination

The subtidal sandbanks feature is currently considered to have **moderate sensitivity** and **high exposure** and therefore **high vulnerability** to toxic contamination. (Note that there is currently insufficient scientific information on the sensitivities of subtidal sandbank communities to radionuclides to determine their vulnerability).

This category includes contamination from synthetic compounds (including pesticides and herbicides), non-synthetic compounds (including heavy metals) and hydrocarbons (oil related products). As a result of the domination of physical conditions within the Estuary, for the majority of biological communities there is little unequivocal evidence of additional impact due to contaminants across the Estuary as a whole. Individual populations may have been impacted close to major discharges however.

Moderately high levels of poly-aromatic hydrocarbons (PAHs) are present in sediments across much of the Estuary (Langston et al., 2003). Generally speaking however, subtidal sediments are less likely to be at risk from oil spills than intertidal sediments unless oil dispersants are used or if wave action causes dispersion of oil into the water column and sediment mobility drives oil into the sediment. Certain species such as amphipods which occur within the Estuary's infralittoral mobile clean sand community have been found to be moderately sensitive to oil pollution. (See also section 5.1).

Despite the presence of several potential sources of radionuclides (Berkeley, Oldbury and Hinkley Nuclear Power Plants, a manufacturer of radiopharmaceuticals in Cardiff and a number of other smaller sources) the accumulation of radionuclides in the Severn Estuary is generally low compared with samples from the Irish Sea. The exceptions to this are Tritium and Carbon 14, which have been found at locally at significant levels. This is thought to be related to discharges from the radiopharmaceutical company in Cardiff, for which remedial action is being taken. The exposure for subtidal sandbanks is therefore thought to be low.

iv. Changes in nutrient loading

The subtidal sandbanks feature is currently considered to have **low sensitivity** and **high exposure** and therefore **moderate vulnerability** to changes in nutrient loading

Whilst nutrient levels and loadings within the Estuary are considered significant in UK terms the high natural turbidity of the system negates these high levels, with algal productivity being generally low except in localised hotspots. Where these do occur, nutrient enrichment may lead to significant shifts in community composition on/in subtidal sandbanks but recoverability is likely to be high.

v. Changes in salinity

The subtidal sandbanks feature is currently considered to have **moderate sensitivity** and **high exposure** and therefore **high vulnerability** to changes in salinity.

Apelochaeta marioni, a polychaete worm which characterizes the shallow sandbanks' biotope of variable salinity infralittoral mobile sand, is very tolerant of low salinity conditions but would be moderately vulnerable to any long-term increases in salinity levels. This species has a wide distribution throughout the Estuary, being present on subtidal and intertidal sand habitats on both sides of the Estuary.

vi. Changes in oxygenation

The subtidal sandbanks feature is currently considered to have **low sensitivity** and **high exposure** and therefore **moderate vulnerability** to changes in oxygenation.

A cycle of changes in oxygenation occurs within the Severn as a result of both seasonal and tidal cycles and is linked to fluctuating sediment regimes. In addition occasional, intermittent oxygen sags occur in low salinity regions of the Severn and in some of the principal rivers feeding the Estuary.

Decreases in oxygenation levels can result from maintenance dredging, aggregate extraction, industrial effluent discharge, land/waterfront runoff and sewage discharge (Langston et al., 2003). Oxygen-deficient

marine areas are characterized by a decline in the number and diversity of species. Certain communities occurring within the Estuary's subtidal sandbanks are moderately sensitive to decreases in dissolved oxygen levels. However, recoverability of these areas should be rapid upon return to normal conditions.

vii. Introduction of microbial pathogens

The subtidal sandbanks feature is currently considered to have **high sensitivity** and **high exposure** and therefore **high vulnerability** to the introduction of microbial pathogens.

Microbial pathogens are most likely to enter the Severn's ecosystem by means of sewage discharges. For the majority of biological communities there is insufficient information available to be able to make an assessment of their sensitivity to microbial pathogens. However, some research has been undertaken on marine bivalves, several species of which occur within the Estuary's sandbanks. Mass mortalities of bivalves can result from diseases caused by bacteria, viruses (over 20 have been described for marine bivalves) or protozoans. There is a greater likelihood of such events occurring in areas adjacent to outfalls than elsewhere. Recovery of populations is probable.

5.6.3 Mudflats and sandflats feature

(Note : this advice is also relevant to the Ramsar Site as the mudflats and sandflats are both a subfeature of the estuaries feature and a supporting habitat of the birds species, for which the Ramsar Site has been designated – refer also to section 5.8)

5.6.3.1 Sensitivity

The **mudflats and sandflats** and their associated biological communities are **moderately to highly sensitive** to:

- **physical loss**
- **physical damage**
- **toxic contamination**
- **non-toxic contamination**
- **biological disturbance**

These result from a range of activities known to occur in the vicinity of the mudflats and sandflats. Further details are provided in points i) to xiii) below, with details of the level of sensitivity set out in Table 22.

5.6.3.2 Exposure

The **mudflats and sandflats** and their associated biological communities are **moderately to highly exposed** to:

- **substratum loss**
- **smothering**
- **changes in suspended sediment**
- **changes in water flow rate**
- **changes in wave exposure**
- **abrasion and physical disturbance**
- **toxic contamination(introduction of synthetic & non synthetic compounds)**
- **changes in nutrient loading**
- **changes in thermal regime**
- **changes in turbidity**
- **changes in salinity**
- **changes in oxygenation**
- **introduction of microbial pathogens**

5.6.3.3 Vulnerability

The **intertidal mudflats and sandflats** communities are **moderately to highly vulnerable** to:

i. Substratum loss

The intertidal mudflats and sandflats feature is currently considered to have **high sensitivity** and **high exposure** and therefore **high vulnerability** to substratum loss.

Areas of intertidal habitats will be lost as a direct result of land claim or developments, or indirectly as a consequence of changes to sedimentation processes (e.g. resulting from the construction of groynes or of seawalls). Consequently, there is moderate to high exposure of mudflats and sandflats to substratum loss. The sediment infauna reside in the uppermost layers of the substratum and the removal of this layer would cause a major decline in species richness as they would have been removed with it. Thus the sensitivity of the biotopes in question is high. Fortunately, recovery of the community is also regarded as being high as recolonisation is likely following deposition of suitable substrata.

ii. Smothering

The intertidal mudflats and sandflats feature is considered to have **moderate sensitivity** and **moderate exposure** and therefore **moderate vulnerability** to smothering

Smothering of organisms is likely to occur as a result of the direct deposition of material on top of them and/or on their habitat. Examples of activities causing smothering in intertidal areas include beach replenishment, port developments, archaeological activities, coastal farming, industrial effluent discharge, oil spills, land runoff including highways discharge and sewage discharge.

iii. Changes in suspended sediment

The intertidal mudflats and sandflats feature is considered to have **moderate sensitivity** and **moderate exposure** and therefore **moderate vulnerability** to changes in suspended sediment

Changes in suspended sediments could change the extent and nature of intertidal habitats including affecting estuary-wide erosion and accretion patterns. Increase in sediment in suspension are unlikely to cause problems unless it leads to smothering (see smothering) and in some cases the invertebrate communities associated with the sediment may provide additional food resources for feeding birds. A decrease in suspended sediments may lead to increased light penetration and changes in the intertidal mud and sandflat communities.

Activities likely to result in changes in suspended sediment would include those which would affect sediment availability or the water flow rate (coastal defences, development, construction and dredging).

iv. Changes in water flow rate

The intertidal mudflats and sandflats feature is currently considered to have **moderate sensitivity** and **high exposure** and therefore **high vulnerability** to changes in water flow rate.

Increases or decreases to the water flow rate are likely to lead to, respectively, increased sediment erosion or accretion in certain areas. Activities/structures responsible for changing the water flow rate include construction activities, groynes, beach replenishment, sea walls/breakwaters, port developments and aggregate extraction.

v. Changes in wave exposure

The intertidal mudflats and sandflats feature is currently considered to have **high sensitivity** and **high exposure** and therefore **high vulnerability** to changes in wave exposure.

Changes in wave exposure result from coastal defence structures (groynes, seawalls, breakwaters and beach replenishment), shipping and possibly aggregate extraction. Increased wave action will disrupt feeding and burrowing, and reduce species abundance, richness and biomass. The strength of wave action determines the topography, steepness and shore width of the intertidal zone.

vi. Abrasion and physical disturbance

The intertidal mudflats and sandflats feature is currently considered to have **moderate sensitivity** and **high exposure** and therefore **high vulnerability** to physical disturbance and abrasion.

The activities most likely to cause abrasion to mudflats and sandflats include beach replenishment, bait digging, maintenance dredging, aggregate extraction, land-based recreation and archaeology. Boating, anchoring, trampling or the use of vehicles are also likely to cause physical disturbance, with compaction of the substratum being of particular concern. For example, the use of vehicles on mudflats or sandflats appears to have a potentially severe impact on gaper clams *Mya arenaria*. Large clams live in permanent burrows and are therefore susceptible to burrow collapse and sediment compaction through trampling and especially vehicle use. Another two key species found in muddy sand, the heart urchin *Echinocardium cordatum* and the razor shell *Ensis ensis*, are probably highly sensitive to physical disturbance. Recovery is likely to be moderate because, although the individual key species may recolonize an area within five years, several of the species are very long-lived and so the biotope may take longer to return to its original age structure and species diversity.

vii. Toxic contamination

The intertidal mudflats and sandflats feature is currently considered to have **high sensitivity** and **high exposure** and therefore **high vulnerability** to toxic contamination by synthetic and non-synthetic compounds. (Note that there is currently insufficient scientific information on the sensitivities of communities present on/in intertidal mudflats and sandflats to radionuclides to determine their vulnerability).

This category includes contamination from synthetic compounds (including pesticides and herbicides), non-synthetic compounds (including heavy metals) and hydrocarbons (oil related products). Infaunal populations present within intertidal sediments are likely to have been impacted close to major discharges, with a number of synthetic compounds known to have elevated concentrations locally (Langston et al., 2003). However, because of the energetic hydrodynamic regime in the Severn, and the resultant high turbidity, there is considerable mixing and redistribution of fines and their associated contamination burden, resulting in a fairly homogenous distribution.

Whilst the concentration of metals within the Estuary's sediments (cadmium, arsenic, chromium, silver, copper, zinc and nickel in particular) are commonly above interim sediment quality guidelines, these only occasionally exceed probable effects levels (Langston et al., 2003).. Contamination loadings of metals will be highest where fine particulates predominate (for example between Avonmouth and Severn Beach, Caldicot Flats, the River Parrett and outer Bridgewater Bay, and between the mouths of the Usk and Taff), and lowest on sands (for example the Middle to Welsh Grounds, and Culver Sands). Bioaccumulation of metals is known to occur widely in invertebrates, though the ecological significance is still uncertain. Note also that the toxicity of metals to many invertebrates increases with decreased salinity and elevated temperature (Langston et al., 2003). Thus many benthic invertebrates living within their normal salinity range may be less susceptible to heavy metal pollution than those living in salinities near the lower limit of their salinity tolerance.

Hydrocarbon compounds are present locally in elevated concentrations (Langston et al., 2003).. Sources include a combination of fossil fuel combustion, shipping, urban run-off, sewage treatment works and various point-source and diffuse discharges from industrialised areas. Moderately high levels of poly-aromatic hydrocarbons (PAHs) are present in sediments across much of the Estuary (Langston et al., 2003).

Overall vulnerability to all toxic contamination is considered 'high' (due to the exposure from sewage inputs being classed as 'high' and also with 'moderate' levels from industrial inputs etc.).

Despite the presence of several potential sources of radionuclides (Berkeley, Oldbury and Hinkley Nuclear Power Plants, a manufacturer of radiopharmaceuticals in Cardiff and a number of other smaller sources) the accumulation of radionuclides in the Severn Estuary is generally low compared with samples from the Irish Sea. The exceptions to this are Tritium and Carbon 14, which have been found at locally at significant levels. This is thought to be related to discharges from the radiopharmaceutical company in Cardiff, for which remedial action is being taken. The intertidal mudflats and sandflats are therefore thought to be moderately exposed to radionuclides (Langston et al, 2003).

viii. Changes in nutrient loading

The intertidal mudflats and sandflats feature is currently considered to have **moderate sensitivity** and **high exposure** and therefore **high vulnerability** to changes in nutrient loading.

The most obvious sign of an increase in nutrient loading (or organic enrichment) on mudflats is the lush growth of green seaweeds on the surface. Such increases coupled with reduced oxygenation typically lead to anaerobic conditions predominating within the sediment. Moderate organic enrichment does provide food which can enhance species diversity but with greater enrichment, the diversity declines and the community becomes increasingly dominated by a few, pollution tolerant, opportunistic species such as the polychaete *Capitella capitata*. In sandier sediments where particle size is greater, the effects of an increase in organic enrichment are less dramatic. However, the structure of the community is still likely to change from one dominated by suspension feeders to one favouring deposit feeders, accompanied by an increase in the abundance of opportunistic species and a decrease in species richness. Note, however,

that the high natural turbidity of the system negates many of these effects, and algal productivity is generally low except in localised hotspots.

ix. Changes in thermal regime

The intertidal mudflats and sandflats feature is currently considered to have **moderate sensitivity** and **moderate exposure** and therefore **moderate vulnerability** to changes in thermal regime

Temperature can affect many biological, physical and chemical geochemical processes within the water column including stratification, mixing and turbidity, nutrients, oxygenation, salinity and pH. For example, activities which can cause short or longterm changes in temperature can include thermal discharges (eg from power station cooling waters and other discharges). Thermal discharges are likely to be between 2 and 10 degrees above ambient temperature and a long term duration of changes may impact on the larval forms and breeding cycles of marine organisms.

x. Changes in salinity

The intertidal mudflats and sandflats feature is currently considered to have **low sensitivity** and **high exposure** and therefore **moderate vulnerability** to changes in salinity

Decreases in salinity are likely to result from heavy rain events and associated land/waterfront run-off and riverine inputs. Localised salinity changes may also result around discharges. The vast floodplain and catchment area of the Severn Estuary results in annual extreme flooding events and prolonged periods of freshwater input to the intertidal areas so the exposure is considered to be high. However the metabolism of intertidal communities cope with vast extremes of conditions which result from the dynamic nature of the estuary's tidal regime and so are considered to have low sensitivity.

xi. Changes in oxygenation

The intertidal mudflats and sandflats feature is currently considered to have **low sensitivity** and **high exposure** and therefore **moderate vulnerability** to changes in oxygenation.

A cycle of changes in oxygenation occurs within the Severn as a result of both seasonal and tidal cycles and is linked to fluctuating sediment regimes. In addition occasional, intermittent oxygen sags occur in low salinity regions of the Severn and in some of the principal rivers feeding the Estuary.

Decreases in oxygenation levels will result from maintenance dredging, aggregate extraction, industrial effluent discharge, land/waterfront runoff and sewage discharge. Oxygen-deficient marine areas are characterized by a decline in the number and diversity of species. Certain communities occurring within the Estuary's intertidal mudflats and sandflats are moderately sensitive to decreases in dissolved oxygen levels. However, recoverability of these areas should be rapid upon return to normal conditions.

xii. Introduction of microbial pathogens

The intertidal mudflats and sandflats feature is currently considered to have **high sensitivity** and **high exposure** and therefore **high vulnerability** to the introduction of microbial pathogens.

Microbial pathogens are most likely to enter the Severn's ecosystem by means of sewage discharges. For the majority of biological communities there is insufficient information available to be able to make an assessment of their sensitivity to microbial pathogens. However, some research has been undertaken on marine bivalves, several species of which occur within the Estuary's intertidal sandbanks. Mass mortalities of bivalves can result from diseases caused by bacteria, viruses (over 20 have been described for marine bivalves) or protozoans. There is a greater likelihood of such events occurring in areas adjacent to outfalls than elsewhere. Recovery of populations is probable.

xiii. Introduction of non-native species

The intertidal mudflats and sandflats feature is currently considered to have **high sensitivity** and **low exposure** and therefore **moderate vulnerability** to the introduction of non-native species.

The saltmarsh cordgrass *Spartina anglica* is an invasive pioneer species whose rapid growth consolidates sediment, raises mudflats and reduces sediment availability elsewhere. It is regarded as being a potential threat to intertidal beds of *Zostera noltei* in particular. However, whilst recognising *S. anglica* as an invasive species, it also has a role in saltmarsh formation and the community SM6 in which it features should be allowed to develop into other Atlantic Salt Meadow or transitional communities. The presence of another non-native, the slipper limpet *Crepidula fornicata*, in large numbers may alter the species composition within certain soft mud habitats leading to a decline in overall species richness. However, *C. fornicata* has yet to penetrate the Estuary, possibly due to the strong water flows.

Note, in relation to ‘noise and visual disturbance’, that while mudflats and sandflats communities have moderate exposure to both noise and visual disturbance, these habitats are not sensitive to these factors but they do provide a vitally important role as supporting habitats for waterfowl that use these areas for roosting and feeding and these are considered highly sensitive to both noise and visual disturbance – see sections 5.7.1 & 5.7.2). So while the habitats themselves have low vulnerability their dependant bird species have high vulnerability.

5.6.4 Atlantic salt meadow feature

(Note : this advice is also relevant to the Ramsar Site as the Atlantic saltmeadows are both a subfeature of the estuaries feature and a supporting habitat of the birds species, for which the Ramsar Site has been designated – refer also to section 5.8)

5.6.4.1 Sensitivity

The **Atlantic salt meadow** and its associated biological communities are **moderately or highly sensitive** to:

- **physical loss**
- **physical damage**
- **toxic contamination**
- **non-toxic contamination**

These result from a range of activities known to occur on or in the vicinity of the salt meadows. Further details are provided in points i) to xiii) below, with details of the level of sensitivity set out in Table 22.

5.6.4.2 Exposure

The **Atlantic salt meadow** and its associated biological communities are **moderately to highly exposed** to:

- **substratum loss**
- **smothering**
- **changes in suspended sediment**
- **changes in water flow rate**
- **changes in wave exposure**
- **abrasion and physical disturbance**
- **changes in grazing management**
- **noise and visual disturbance**
- **toxic contamination(introduction of synthetic & non synthetic compounds)**
- **changes in nutrient loading**
- **changes in salinity**
- **changes in oxygenation**
- **introduction of microbial pathogens**

5.6.4.3 Vulnerability

The **saltmarsh** communities are **moderately to highly vulnerable** to:

i. Substratum loss

The Atlantic salt meadows and their associated communities feature is currently considered to have **high sensitivity** and **high exposure** and therefore **high vulnerability** to substratum loss

Saltmarshes, cordgrass and *Salicornia* are highly sensitive to physical loss. This can occur mostly through one-off developments such as infrastructure construction and modification involving land claim and changes in land management and coastal farming, and also as a result of coastal squeeze. This is a process by which coastal features such as saltmarshes and *Salicornia* are eroded as they become trapped between man-made structures such as sea walls and rising sea levels. Where this occurs on saltmarshes, it may result in the replacement of mid-marsh communities by pioneer saltmarsh communities or through erosion changing saltmarsh to intertidal mud and sand. Changes to coastal processes may also affect the sediment budget of estuaries and reduce the supply of sediment to saltmarsh, *Salicornia* and cordgrass areas. Whilst some areas of the Estuary are subject to these pressures, others are not, yet it remains a real

threat as is reflected in the moderate to high exposure score. When combined with high sensitivity this leads to a high vulnerability.

ii. Smothering

The Atlantic salt meadows feature is considered to have **high sensitivity** and **moderate exposure** and therefore **high vulnerability** to smothering.

Smothering of saltmarsh is likely to occur as a result of the direct deposition of material on the surface. This can happen by either direct deposition of materials on land or through silt-laden tides. The saltmarshes of the Severn are subject to spring tides each year which can in some locations deposit a thick layer of sediment on the surface which can persist for some months. Normally the level of this natural deposition is compatible with the speed of vertical accretion and growth of the saltmarsh. Higher levels of sediment deposition which may be associated with development activities (increasing sediment suspension) can cause smothering to occur resulting in loss of vegetation or shifts in community composition and zonation. Examples of activities likely to cause smothering from tidal deposition include coastal defence works, dredging, construction and archaeological works. Examples of direct deposition are fly tipping and accumulation of tidal debris.

iii. Changes in suspended sediment

The Atlantic salt meadows and their associated communities feature is currently considered to have **moderate sensitivity** and **moderate exposure** and therefore **moderate vulnerability** to changes in suspended sediment

Changes in suspended sediments could change the extent and nature of saltmarsh communities and other intertidal habitats including affecting estuary-wide erosion and accretion patterns. Increases in suspended sediment are unlikely to cause problems unless it leads to smothering (see smothering).

Activities likely to result in changes in suspended sediment would include those which would affect sediment availability or the water flow rate (coastal defences, development, construction and dredging).

iv. Desiccation and changes in emergence regime

The Atlantic salt meadows and their associated communities feature is currently considered to have **high sensitivity** and **low exposure** and therefore **moderate vulnerability** to desiccation and changes in emergence regime

Changes in the emergence regime will result in changes in the time habitats or species spend either covered in water or exposed to the air, one consequence of which is the desiccation (drying) of habitats and species. Examples of activities which may induce these changes are the construction of coastal and flood defences and other developments which change the tidal regime and water flow characteristics of the estuary.

The morphology, zonation and composition of saltmarshes are determined by their position within the tidal frame. They therefore considered highly sensitive to changes in the emergence regime and desiccation in particular.

These changes occurring in saltmarshes may result in either the stranding and exposure of communities or lengthened periods of inundation and lack of drying out with consequent impacts on species composition of swards (through dieback and shifts in community types) and affecting their suitability for species dependant on them. These changes may also cause the expansion of *Spartina* into both saltmarsh habitats and across adjacent mudflats.

The size of the estuary means that most small scale activities will have limited impacts with only large scale or estuary-wide activities likely to be of concern and exposure to this operation is therefore currently considered as low.

v. Changes in water flow rate

The Atlantic salt meadows and their associated communities feature is currently considered to have **moderate sensitivity** and **high exposure** and therefore **high vulnerability** to changes in water flow rate.

A reduction in the rate of water flow over the saltmarsh will result in an increase in the deposition of sediment. The rate at which this occurs will depend on the sediment supply, the duration of the tidal cover and the extent to which the tidal flow is impeded by the vegetation itself to facilitate deposition. Saltmarsh communities actually require a degree of sediment deposition in order to survive and flourish and they have been assessed as having a low to moderate sensitivity. Exposure to changes in water flow rate on saltmarsh communities will vary throughout the Estuary.

vi. Changes in wave exposure

The Atlantic salt meadows and their associated communities feature is currently considered to have **high sensitivity** and **high exposure** and therefore **high vulnerability** to changes in wave exposure.

Changes in wave exposure result from the presence of coastal defence structures (groynes, seawalls, breakwaters), beach replenishment and possibly aggregate extraction. Increased wave action can have two opposing effects. On the one hand it is likely to lead to a greater amount of suspended sediment being carried to the saltmarsh, while on the other hand the greater energy regime is likely to prevent the settlement of this material and may even remove material from the saltmarsh through erosion at the saltmarsh edge. A decrease in wave action will lead to greater sediment deposition with the possibility of smothering.

vii. Abrasion and physical disturbance

The Atlantic salt meadows and their associated communities feature is currently considered to have **moderate sensitivity** and **high exposure** and therefore **high vulnerability** to physical disturbance and abrasion.

Physical disturbance or abrasion to saltmarsh communities may result from a wide range of activities including recreational usage (both land-based and water-based), any of which may damage individual saltmarsh plants or areas of saltmarsh. Trampling by foot, and particularly by off-road vehicles, causes localised damage which may impact upon the ecological structure and function of larger areas, and requiring long-term recovery. Saltmarshes are also sensitive to erosion as a result of trampling or overgrazing, with communities that support succulents such as *Limonium* spp. being very susceptible to any form of grazing. In addition, it is widely recognised that shipping and boating can increase saltmarsh erosion from their wash.

viii. Changes in grazing management

The Atlantic salt meadows and their associated communities feature is currently considered to have **high sensitivity** and **high exposure** and therefore **high vulnerability** to changes in grazing management.

The presence, duration and intensity of grazing management can alter the vegetation composition and structure of saltmarsh habitats. Abandonment or introduction of grazing can result in changes in the saltmarsh plant and animal communities which are important in their own right and which also provide food resources for passage and wintering birds. Grazing changes may also affect the suitability of saltmarsh areas as resting and roosting sites for birds where open terrain with low vegetation is an important factor. Changes may also affect the presence of specific niches for scarce and notable plants.

ix. Toxic contamination

The Atlantic salt meadows and their associated communities feature is currently considered to have **moderate to high sensitivity** and **high exposure** and therefore **high vulnerability** to toxic contamination from both synthetic and non-synthetic compounds.

Atlantic salt meadows, cordgrass swards and *Salicornia* within the Estuary are considered to have a moderate sensitivity to toxic contamination by synthetic compounds (which includes domestic/industrial effluent, pesticides, anti-foulant paints and PCBs) and a high sensitivity to non-synthetic compounds

(which includes domestic/industrial effluent, heavy metals and hydrocarbons). Although saltmarsh plants may be reasonably tolerant of certain synthetic substances, they can bioaccumulate toxic compounds and act as sinks for them. This could have implications for wildfowl which feed on saltmarsh plants.

Saltmarsh communities are also highly sensitive to oil and oil products, even at relatively low levels. This is mainly by virtue of their ability to trap sediments. Acute events, such as oil spills, can be particularly damaging to saltmarsh plants. Dispersants used to treat oil spills can also have a toxic effect on saltmarsh plants, sometimes to a greater degree than the spilled oil itself. Saltmarshes have been reported to recover from chronic oil pollution, where denuded of vegetation, within ten years, although recovery depends largely on the degree to which oil is retained in the sediment and the clean up procedures used.

x. Changes in nutrient loading

The Atlantic salt meadows and their associated communities feature is currently considered to have **moderate sensitivity** and **high exposure** and therefore **high vulnerability** to changes in nutrient loading.

The Estuary's saltmarshes and associated communities are thought to be more susceptible to nutrient enrichment than was previously realised (Deegan, L. A. et al. 2007), so they have been assessed as being of high sensitivity to increases in nutrient loading and/or organic enrichment. However, increased growth of certain seaweed species may result from elevated levels of nitrates and phosphates and cause local smothering which is known to have a detrimental effect on glasswort (*Salicornia* spp.) in low marsh communities. In addition, the species composition of the plants on the saltmarsh may be altered by changes in nutrient loading leading to a change in the structure of the sward.

xi. Changes in salinity

The Atlantic salt meadows and their associated communities feature is currently considered to have **moderate sensitivity** and **high exposure** and therefore **high vulnerability** to changes in salinity.

Changes to the salinity of water flowing across the saltmarshes as a result of the tides are likely to occur following heavy rain events and associated land/waterfront run-off and riverine inputs. The vast floodplain and catchment area of the Severn Estuary results in annual extreme flooding events and prolonged periods of freshwater input to the intertidal areas so the exposure is considered to be high. The botanical composition of the saltmarshes reflects salinity. The saltmarshes, while capable of tolerating a wide range of salinities, are considered moderately sensitive to changes in salinity particularly prolonged periods of change which can cause shifts in composition and zonation.

xii. Changes in oxygenation

The Atlantic salt meadows and their associated communities feature is currently considered to have **low sensitivity** and **high exposure** and therefore **moderate vulnerability** to changes in oxygenation.

A cycle of changes in oxygenation occurs within the Severn as a result of both seasonal and tidal cycles and is linked to fluctuating sediment regimes. In addition occasional, intermittent oxygen sags occur in low salinity regions of the Severn and in some of the principal rivers feeding the Estuary.

xiii. Introduction of microbial pathogens

The Atlantic salt meadows and their associated communities feature is currently considered to have **low sensitivity** and **high exposure** and therefore **moderate vulnerability** to the introduction of microbial pathogens

For the majority of saltmarsh communities there is insufficient information available to be able to make an assessment of their sensitivity to microbial pathogens.

*Note, in relation to 'noise and visual disturbance', that while Atlantic salt meadows and their associated plant communities have **high exposure** to both noise and visual disturbance, these habitats are **not sensitive** to these factors but they do provide a vitally important role as supporting habitats for waterfowl that use these areas for roosting and feeding and these are considered **highly sensitive** to both noise and*

visual disturbance – see sections 5.7.1 & 5.7.2). So while the habitats themselves have **low vulnerability** their dependant bird species have high vulnerability.

5.6.5 Reefs feature

5.6.5.1 Sensitivity

The **reefs** and their associated biological communities are **moderately to highly sensitive** to:

- **physical loss**
- **physical damage**

These result from a range of activities. Note that there is currently insufficient scientific information to assess the degree of sensitivity of reefs to **toxic & non-toxic contamination** and also to **biological disturbance**. In these cases, the precautionary principle has been applied with a **moderate level of sensitivity** being assumed until proven otherwise. Further details are provided in points i) to vii) below, with details of the level of sensitivity set out in Table 22.

5.6.5.2 Exposure

The **reefs** and associated biological communities are **moderately to highly exposed** to:

- **changes in suspended sediment**
- **toxic contamination (introduction of synthetic & non synthetic compounds)**
- **changes in nutrient loading**
- **changes in turbidity**
- **changes in salinity**
- **changes in oxygenation**
- **introduction of microbial pathogens**

The reefs of the Severn Estuary are biogenic in origin, that is, they are built by a concretion-forming organism creating elevated structures. The organism in this case is the honeycomb worm *Sabellaria alveolata*. These reefs occur both in the intertidal (where one might expect to find them) and, most unusually, in the subtidal. Indeed, the Severn Estuary has the only extensive subtidal *Sabellaria alveolata* reef in Britain. There has been little research undertaken on these subtidal *Sabellaria alveolata* reefs, so the scientific information on their sensitivities is extremely limited. In the advice given here, much has been drawn on the information known about subtidal reefs of the closely related *Sabellaria spinulosa*.

5.6.5.3 Vulnerability

The **reef** communities are **moderately to highly vulnerable** to:

i. Changes in suspended sediment

The reefs feature is currently considered to have **moderate sensitivity** and **moderate exposure** and therefore **moderate vulnerability** to changes in suspended sediment

The reduced availability of sand, essential for *S. alveolata* tube building, may lead to the reduced development of *S. alveolata* reefs and the decline of colonies. Increase in suspended sediment is unlikely to cause problems unless it leads to smothering of the reef. Activities likely to result in changes in suspended sediment would include those which would affect sediment availability or the water flow rate (coastal defences, development, construction and dredging).

ii. Toxic contamination

The **sensitivity** of *Sabellaria alveolata* to toxic contaminants (domestic effluent, industrial effluent, heavy metals, hydrocarbons) entering the water is **not known**. The precautionary principle should therefore be applied.

The reefs are considered to have **high exposure** to both synthetic compounds and non-synthetic compounds (industrial effluents, heavy metals, hydrocarbons etc.),

The reefs are therefore **moderately vulnerable** to the introduction of synthetic compounds and non-synthetic compounds.

iii. Changes in nutrient loading

The reefs feature is currently considered to have **low sensitivity** and **high exposure** and therefore **moderate vulnerability** to changes in nutrients.

iv. Changes in salinity

The reefs feature is currently considered to have **low sensitivity** and **high exposure** and therefore **moderate vulnerability** to changes in salinity.

Decreases in salinity within the Estuary are likely to result from heavy rain events and associated land/waterfront run-off and riverine inputs. The vast floodplain and catchment area of the Severn Estuary results in annual extreme flooding events and prolonged periods of freshwater input the estuary so the exposure is considered to be high.

v. Changes in oxygenation

The reefs feature is currently considered to have **low sensitivity** and **high exposure** and therefore **moderate vulnerability** to changes in oxygenation.

A cycle of changes in oxygenation occurs within the Severn as a result of both seasonal and tidal cycles and is linked to fluctuating sediment regimes. In addition occasional, intermittent oxygen sags occur in low salinity regions of the Severn and in some of the principal rivers feeding the Estuary.

vi. Introduction of microbial pathogens

Microbial pathogens are most likely to enter the Severn's ecosystem by means of sewage discharges. There is considered to be **high exposure** to microbial pathogens due to the high number of sewage discharges within the estuary.

For the majority of biological communities there is insufficient information available to be able to make an assessment of their sensitivity to microbial pathogens and there is currently no information on the sensitivity of *Sabellaria* reefs to the introduction of microbial pathogens. The vulnerability of the *Sabellaria* reefs therefore remains unknown and the precautionary principle should be applied.

vii. Introduction of non-native species

There is insufficient information on the sensitivity of reefs to introduction of non native species therefore the vulnerability is unknown.

5.6.6 Shad and lamprey features

(Note : this advice is also relevant to the Ramsar Site as these features are also part of the “assemblage of migratory fish species” for which the Ramsar Site has been designated – refer also to section 5.8)

Note that in the explanatory text that follows, the term ‘shad and lamprey’ refer to three species of migratory fish: twaite shad *Alosa fallax*, river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus*.

As the populations of these migratory fish depend upon the freshwater habitats of the Rivers Usk, Wye and Severn as well as the estuarine habitats of the Severn Estuary during their lifetime, the advice presented here should be read in conjunction with the advice given for the River Usk SAC and the River Wye SAC (Management Plans and Conservation Objectives) available from CCW and Natural England on request.

5.6.6.1 Sensitivity

The **shad and lamprey** are considered **sensitive** to:

- **physical damage** of their supporting habitats
- **non-physical disturbance**
- **toxic contamination**
- **non-toxic contamination**
- **biological disturbance**

These result from a range of activities known to occur within the Estuary on which further details are provided in points i) to xi) below.

5.6.6.2 Exposure

The **shad and lamprey** and their supporting habitats (whilst within the Estuary) are **moderately to highly exposed** to:

- **noise** (part of ‘noise and visual presence’ but latter not applicable)
- **toxic contamination(introduction of synthetic & non synthetic compounds)**
- **changes in nutrient loading**
- **changes in thermal regime**
- **changes in turbidity**
- **changes in salinity**
- **changes in oxygenation**
- **introduction of microbial pathogens**

The Estuary provides an important migration route for these three rare species, to and from their spawning and nursery grounds. Shad and lamprey are known to be present in coastal and estuarine waters throughout the year, though there remains a lack of information on these migratory species during the time they actually spend in the Estuary. More information exists for the rivers where they migrate to spawn and for the subsequent development of juveniles. Little is known of their biology and distribution during the marine part of their life cycle.

In the assessments given below, it is assumed that these species would be capable of avoiding unsuitable areas, that is, given the size of the Estuary, localized activities are unlikely to adversely affect the population.

5.6.6.3 Vulnerability

Assessment of vulnerability of these features is particularly difficult given that there is little or no information to enable the level of sensitivity to be established. In line with the “precautionary principle” **where there is moderate to high exposure the feature is considered vulnerable.**

Therefore the **shad and lamprey** are considered **vulnerable** to:

i. Noise (part of ‘noise and visual presence’ but latter not applicable)

Research has shown that shad are sensitive to vibration which can arise from noisy activities. High frequency vibration (70 – 300Khtz) can be barrier to migration affecting movement both up and downstream and preventing fish reaching spawning areas. In some circumstances high frequency vibrations can be fatal. Vibration sources need to be assessed at the planning and consent stage and their potential impacts mitigated for, particularly during the key upstream migration phase.

ii. Toxic contamination

A decrease in water quality within the Estuary may impede the migration of these fish to their spawning grounds in the rivers. Poor water quality may also affect their supply of food. Shad require a good supply of small crustacean prey species, especially mysids and small fish (particularly clupeids). At sea, river lamprey feed on a variety of small fish such as clupeids, whilst sea lamprey feed on larger fish including salmon. Pollution tolerance levels of shad and lamprey are unknown, but EA water quality policy is that levels should comply with targets established under the EA Review of Consents and the Water Framework Directive.

iii. Changes in nutrient loading

It is possible that changes in nutrient levels may affect the food supply of the shad and lamprey. However, due to the natural high turbidity of the system and the volumes of water involved, it is thought that any effects would be minimal.

iv. Changes in thermal regime

Water temperature is believed to act as a trigger for the shad to migrate upstream to spawn in the rivers. There could be changes in water temperature in the vicinity of the power stations (eg Hinkley Point and Oldbury) and from other discharges

v. Changes in turbidity

It is not known whether the migratory fish are sensitive to changes in turbidity within the Estuary. Given the extremely high background levels of turbidity, it is unlikely that any changes in turbidity will have any significant impact on the shad and lamprey whilst in the estuarine waters.

vi. Changes in salinity

Decreases in salinity within the Estuary are likely to result from heavy rain events and associated land/waterfront run-off and riverine inputs. The vast floodplain and catchment area of the Severn Estuary results in annual extreme flooding events and prolonged periods of freshwater input the estuary so the exposure is considered to be high. Within the Estuary, juvenile twaite shad prey on mysids feeding at the salt wedge near the head of the tide. It must be assumed that any activities affecting the salinity regime of the estuary would in turn affect the distribution of these prey species, which may have consequences for the shad.

vii. Changes in oxygenation

A cycle of changes in oxygenation occurs within the Severn as a result of both seasonal and tidal cycles and is linked to fluctuating sediment regimes. In addition occasional, intermittent oxygen sags occur in low salinity regions of the Severn and in some of the principal rivers feeding the Estuary. Shad and lamprey may therefore be vulnerable to changes in oxygenation given the high exposure to changes resulting from operations within the Estuary.

viii. Introduction of microbial pathogens

There is insufficient information available to make any meaningful assessment on the introduction of microbial pathogens to these species of fish, but there is potential for high exposure.

Note regarding ‘changes in water flow rate’

It is thought unlikely that changes in water flow rate within the Estuary will affect these fish but they are likely to be affected (and therefore vulnerable) once in the rivers where water abstraction and freshwater flows may have more of a bearing.

Note regarding ‘selective extraction of species’

After hatching in the rivers, young shad gradually move downstream into the upper estuary where they feed and mature until the end of their second summer before moving into coastal waters. Young shad feed on estuarine invertebrates while adult shad feed on mysids and other fish (particularly other clupeids such as sprat and herring). Both river and sea lamprey spend several years of development in riverine mud and then, after a relatively rapid metamorphosis, migrate downstream to the estuary. River lamprey feed on a variety of estuarine fish, particularly herring, sprat and flounder. At sea, sea lamprey feed on larger fish including large salmon.

Extraction of target species - *it is reported that twaite shad are vulnerable to capture on cooling water intakes, particularly those associated with power stations, where the numbers killed can be considerable.*

Extraction on non target species - *the shad and lamprey may be vulnerable to the extraction of their prey species (levels unknown) affecting their feeding behavior and patterns and long-term survival.*

Table 22 Sensitivity, exposure and vulnerability of the Severn Estuary SAC to physical, chemical and biological pressures

Sensitivity		Exposure		Vulnerability	
High sensitivity	OOO O	High Exposure	× × × ×	High vulnerability	⊗⊗⊗⊗ ⊗⊗⊗O ⊗⊗⊗×
Moderate sensitivity	OOO	Medium Exposure	× × ×	Moderate vulnerability	⊗⊗OO ⊗⊗× × ⊗⊗⊗
Low sensitivity	OO	Low Exposure	× ×	Low vulnerability	⊗⊗O ⊗××× ⊗⊗× ⊗×× ⊗⊗ ⊗×
No detectable sensitivity	O	No exposure	×	No vulnerability	⊗O
?S=Insufficient information on sensitivity; ✓ = migratory fish considered to be sensitive, but insufficient information to assess level of sensitivity					Unknown vulnerability

Categories of operations which may cause deterioration or disturbance ²⁵	Annex I features						Annex II species
	Estuaries	Subtidal Sandbanks	Mudflats & sandflats	Atlantic saltmeadow	Reefs		Fish ²⁶
Physical loss							
Removal / substratum loss	⊗⊗⊗⊗	⊗⊗⊗	⊗⊗⊗⊗	⊗⊗⊗⊗	⊗⊗O		⊗×
Smothering	⊗⊗⊗O	⊗⊗×	⊗⊗⊗	⊗⊗⊗O	⊗⊗		⊗×
Physical damage							
Changes in suspended sediment	⊗⊗⊗	⊗⊗⊗	⊗⊗⊗	⊗⊗⊗	⊗⊗⊗		⊗×
Desiccation & changes in emergence regime	⊗⊗O	⊗O	⊗⊗O	⊗⊗OO	⊗O		✓××
Changes in water flow rate	⊗⊗⊗×	⊗⊗O	⊗⊗⊗×	⊗⊗⊗×	⊗⊗O		✓××
Changes in wave exposure	⊗⊗⊗⊗	⊗⊗O	⊗⊗⊗⊗	⊗⊗⊗⊗	⊗⊗O		⊗×
Abrasion / physical disturbance (of habitats)	⊗⊗⊗×	⊗⊗×	⊗⊗⊗×	⊗⊗⊗×	⊗⊗O		✓××
Changes in grazing management	⊗⊗	Not relevant	Not relevant	⊗⊗⊗⊗	Not relevant		Not relevant
Non-physical disturbance							
Noise & visual presence	⊗××	⊗××	⊗⊗×	⊗×××	⊗×		✓×××
Toxic contamination							
Introduction of synthetic compounds	⊗⊗⊗×	⊗⊗⊗×	⊗⊗⊗⊗	⊗⊗⊗×	⊗⊗××		✓××××
Introduction of non-synthetic compounds	⊗⊗⊗×	⊗⊗⊗×	⊗⊗⊗⊗	⊗⊗⊗⊗	?S××××		✓××××
Introduction of radionuclides	?S××	?S××	?S××	?S××	?S××		✓××
Non-toxic contamination²⁷							
Changes in nutrient loading	⊗⊗⊗⊗ ²⁸	⊗⊗××	⊗⊗⊗×	⊗⊗⊗×	⊗⊗××		✓××××
Changes in thermal regime	⊗⊗⊗	⊗⊗	⊗⊗⊗	⊗⊗	⊗⊗		✓××××
Changes in turbidity ²⁹ (light penetration)	⊗⊗×	⊗⊗×	⊗⊗×	⊗×	⊗××		✓××
Changes in salinity	⊗⊗⊗×	⊗⊗⊗×	⊗⊗××	⊗⊗⊗×	⊗⊗××		✓××××
Changes in oxygenation	⊗⊗⊗×	⊗⊗××	⊗⊗××	⊗⊗××	⊗⊗××		✓××××
Biological disturbance							
Introduction of microbial pathogens	⊗⊗⊗⊗	⊗⊗⊗⊗	⊗⊗⊗⊗	⊗⊗××	?S××××		✓××××
Introduction of non-native species	⊗⊗⊗O	⊗⊗O	⊗⊗OO	⊗⊗	?S××		✓××
Selective extraction of species	⊗⊗⊗×	⊗⊗	⊗⊗	⊗⊗	⊗⊗		✓××

²⁵ For a further explanation of each category see <http://www.marlin.ac.uk/sah/baskitemplate.php?benchmarks>

²⁶ River lamprey, sea lamprey & twaite shad

²⁷ All elements of non toxic contamination are interrelated and also link closely with changes in suspended sediment (physical damage)

²⁸ The high natural turbidity of the estuary negates these high levels with algal productivity being generally low – the estuary feature is therefore not considered vulnerable – see section 5.6.1.3.(viii)

²⁹ Turbidity here incorporates light penetration; suspended sediment under ‘changes in suspended sediment’ and its deposition under ‘smothering’

5.7 Specific Advice on Operations for the Severn Estuary SPA

This section provides information to help relate general advice to each of the specific interest features of the Severn Estuary SPA. Where specific examples are given they are provided to aid understanding of possible impacts and are not intended to be a comprehensive list of all relevant operations.

This advice relates to the vulnerability of the interest features and supporting habitats of the Severn Estuary SPA as set out in Table 23. An explanation of the sensitivity of the interest features or supporting habitats follows with an explanation of their exposure and therefore their vulnerability to damage or disturbance from the listed categories of operations. This enables links between the categories of operation and the ecological requirements of the SPA's interest features (as set out in Section 2.2) to be made. It should be noted that sensitivity scorings are a combination of whether the habitat itself is likely to be affected by a particular operation (which is drawn from the SAC scores in Table 22), in combination with an assessment as to whether the outcome is likely to affect the bird's use of that habitat.

Note that this advice for the SPA supercedes that issued to ASERA in February 2005 following reassessment of exposure, sensitivity and vulnerability to take account of availability of new information in the Severn Estuary CHaMP and MarLIN sensitivities and following the more detailed analysis of impacts on the SAC estuarine habitats that are supporting habitats for the birds of the SPA.

5.7.1 Internationally important populations of regularly occurring Annex 1 species (Bewick's swan)

(Note : this advice is also relevant to the Ramsar Site's internationally important population of waterfowl "Bewick's swan" feature and as part of the "internationally important assemblage of waterfowl" feature for which the Ramsar Site has been designated – refer also to section 5.8)

5.7.1.1 Sensitivity

The Annex 1 species is **moderately to highly sensitive** to :

- **Physical loss**
- **Physical damage**
- **Non-physical disturbance**
- **Toxic contamination**
- **Non- toxic contamination**
- **Biological disturbance**

These result from a range of activities known to occur within the Estuary. Further details are provided in points i) to xii) below, with details of the level of sensitivity set out in Table 23.

5.7.1.2 Exposure

The Annex 1 species is **moderately to highly exposed** to:

- **Substratum loss and smothering**
- **Changes in suspended sediment**
- **Desiccation and changes in emergence regime**
- **Changes in water flow**
- **Changes in wave exposure**
- **Changes in grazing regime**
- **Noise and visual disturbance**
- **Toxic contamination**
- **Changes in nutrient loading**
- **Changes in salinity**
- **Changes in oxygenation**
- **Introduction of microbial pathogens**

5.7.1.3 Vulnerability

The Annex 1 species is **moderately to highly vulnerable** to:

i. Substratum loss and smothering

The intertidal habitats and therefore the Bewick's Swan feature which these habitats support are considered to have **moderate to high sensitivity** and **moderate to high exposure** and therefore **moderate to high vulnerability** to physical loss (removal and smothering).

The physical loss of areas of intertidal habitats may be caused directly through change of land use or indirectly as a consequence of changes to sedimentation processes (e.g. coastal defences) as well as via the effects of smothering by artificial structures (e.g. jetties) or the disposal of spoils. Activities or developments resulting in physical loss of the intertidal supporting habitats are likely to reduce the availability of food and roosting habitat and thus be detrimental to the favourable condition of the SPA interest features including the Annex 1 species, Bewick's swan. The intertidal mudflats and sandflats and the saltmarsh are highly sensitive to removal by land reclamation and major construction activities.

ii. Changes in suspended sediment

It is thought unlikely that changes in the suspended sediment within the Estuary will affect the Bewick's Swan directly but such changes may have marked effects on the supporting habitats on which they are dependant for roosting and feeding. The saltmarshes and intertidal mudflats and sandflats are currently considered to have **moderate sensitivity** and **moderate exposure** and therefore **moderate vulnerability** to changes in suspended sediments. (Refer also to sections 5.6.3 and 5.6.4). Impacts on the suitability of these habitats may affect the long term survival of individuals (in terms of energy and competition) or alter behavior and patterns of use or distribution.

iii. Desiccation and changes in emergence regime

It is thought unlikely that changes in the emergence regime within the Estuary will affect the Bewick's Swan directly but such changes may have marked effects on the supporting habitats on which they are dependant for roosting and feeding. The saltmarshes are currently considered to have **high sensitivity** and **low exposure** and therefore **moderate vulnerability** to desiccation and changes in emergence regime. (Refer also to section 5.6.4.) Impacts on the suitability of these habitats may affect the long term survival of individuals (in terms of energy and competition) or alter behavior and patterns of use or distribution.

iv. Changes in water flow rate

It is thought unlikely that changes in water flow rate within the Estuary will affect the Bewick's Swan directly but such changes may have marked effects on the supporting habitats on which they are dependant for roosting and feeding. The saltmarshes and intertidal mudflats and sandflats of the estuary are considered to have **moderate sensitivity** and **high exposure** and therefore **high vulnerability** to changes in water flow rate. (Refer also to sections 5.6.3 and 5.6.4). Impacts on the suitability of these habitats may affect the long term survival of individuals (in terms of energy and competition) or alter behavior and patterns of use or distribution.

v. Changes in wave exposure

It is thought unlikely that changes in wave exposure within the Estuary will affect the Bewick's Swan directly but such changes may have marked effects on the supporting habitats on which they are dependant for roosting and feeding. The saltmarshes and intertidal mudflats and sandflats of the estuary are considered to have **high sensitivity** and **high exposure** and therefore **high vulnerability** to changes in water flow rate. (Refer also to sections 5.6.3 and 5.6.4). Impacts on the extent and suitability of these habitats may affect the long term survival of individuals (in terms of energy and competition) or alter behavior and patterns of use or distribution.

vi. Changes in grazing management

The Bewicks Swan feature, which is dependent on the saltmarsh habitats, is considered to have **high sensitivity** and **high exposure** and therefore **high vulnerability** to changes in grazing management.

The vegetation composition of saltmarsh habitats can be altered by changes in grazing management. This can affect the palatability of the sward for grazing Bewick's swans and therefore affect the availability of adequate preferred feeding areas within the SPA. There are critical areas for this species located at the Dumbles in the uppermost part of the estuary all of which are grazed.

vii. Noise and visual presence

Overwintering birds are disturbed by sudden movements and sudden noises. This can displace the birds from their feeding grounds. Disturbance can prevent the birds from feeding and in response they either a) decrease their energy intake at their present (disturbed) feeding site through displacement activity, or b) move to an alternative less favoured feeding site. Such a response affects energy budgets and thus survival. There is intermittent disturbance from both the landward and seaward side of the site. Bewick's swans are mainly affected by disturbance from the landward side and any increase in disturbance should be avoided. At present the Annex 1 species are **moderately vulnerable** to noise and visual disturbance on the intertidal mudflats and sandflats and have a **high vulnerability** to this category of operation on the saltmarsh.

viii. Toxic contamination through the introduction of synthetic and/or non-synthetic compounds

Waterfowl are subject to the accumulation of toxins through the food chain or through direct contact with toxic substances when roosting or feeding. Their ability to feed can also be affected by the abundance or change in palatability of their prey caused by toxic contamination. At the moment there is no evidence to show that this is the case, but the estuary is vulnerable to oil spills and there is a continuous discharge of toxins into the estuary,

some of which bind to the sediments. This is an area which requires further assessment and is likely to be addressed by work arising from both the Water Framework Directive and ongoing Review of Consents by the Environment Agency. The Bewick's swans has a **moderate vulnerability** to toxic contamination.

ix. Changes in nutrient loading

Changes in organic or nutrient loading can change the species composition of the plants on the saltmarsh and thus the structure of the sward. This could affect the palatability of the sward for grazing Bewick's swans and therefore affect the availability of adequate preferred feeding areas within the SPA. There are critical areas for this species located at the Dumbles in the uppermost part of the estuary all of which are grazed.

x. Changes in salinity

It is thought unlikely that changes in salinity within the Estuary will affect the Bewicks Swan feature directly but such changes may have marked effects on the supporting saltmarsh habitats on which this species are dependant for feeding. The saltmarshes of the estuary are considered to have **moderate sensitivity** and **high exposure** and therefore **high vulnerability** to changes in salinity. Impacts on these habitats may affect the long term survival of individuals (in terms of energy and competition) or alter behavior and patterns of use or distribution.

xi. Changes in oxygenation

It is thought unlikely that changes in oxygenation within the Estuary will affect the Bewicks Swan feature directly but such changes may have an effect on the community composition of supporting saltmarsh habitats on which this species are dependant for feeding. The saltmarshes of the estuary are considered to have **low sensitivity** and **high exposure** and therefore **moderate vulnerability** to changes in oxygenation. Impacts on these habitats may affect the long term survival of individuals (in terms of energy and competition) or alter behavior and patterns of use or distribution.

xii. Introduction of microbial pathogens

Bewicks swan is considered to have **low sensitivity** and **high exposure** (due to the high number of sewage discharges) and therefore **moderate vulnerability** to the introduction of microbial pathogens.

Microbial pathogens are most likely to enter the Severn's ecosystem by means of sewage discharges. Bewicks swans on their feeding or roosting grounds may be affected by direct infection by pathogens (bacteria or viruses) present in the water or river sediments and through the release of endo or exotoxins bacterial toxins. Infection may cause mortality, loss of condition and behavioural changes in individuals and within the population using the site through onward contamination.

5.7.2 Internationally important waterfowl assemblage including populations of regularly occurring migratory species

(Note : this advice is also relevant to the Ramsar Site's "internationally important populations of waterfowl" features and the "internationally important assemblage of waterfowl" feature for which the Ramsar Site has been designated – refer also to section 5.8)

5.7.2.1 Sensitivity

The Internationally important waterfowl assemblage including populations of regularly occurring migratory species is **moderately to highly sensitive** to:

- Physical loss
- Physical damage
- Non-physical disturbance
- Toxic contamination
- Non-Toxic contamination
- Biological disturbance

These result from a range of activities known to occur within the Estuary. Further details are provided in points i) to xvi) below, with details of the level of sensitivity set out in Table 23.

5.7.2.2 Exposure

The Internationally important waterfowl assemblage including populations of regularly occurring migratory species is **moderately to highly exposed** to:

- Substratum loss and smothering
- Changes in suspended sediment
- Desiccation and changes in emergence regime
- Changes in water flow
- Changes in wave exposure
- Abrasion and physical disturbance
- Grazing management
- Noise and visual disturbance
- Toxic contamination
- Changes in nutrient loading
- Changes in thermal regime
- Changes in salinity
- Changes in oxygenation
- Introduction of microbial pathogens
- Introduction of non-native species
- Selective extraction of species

5.7.2.3 Vulnerability

The Internationally important waterfowl assemblage including populations of regularly occurring migratory species has **moderate to high vulnerability** to:

i. Substratum loss and smothering

The intertidal habitats and therefore the waterfowl assemblage feature which these habitats support are considered to have **moderate to high sensitivity** and **moderate to high exposure** and therefore **moderate to high vulnerability** to physical loss (substratum loss and smothering).

The physical loss of areas of intertidal habitats may be caused directly through change of land use or indirectly as a consequence of changes to sedimentation processes (e.g. coastal defences) as well as via the effects of smothering by artificial structures (e.g. jetties) or the disposal of spoils. Activities or developments resulting in

physical loss of the intertidal supporting habitats are likely to reduce the availability of food and roosting habitat and thus be detrimental to the favourable condition of the SPA interest features including all the migratory species and waterfowl assemblage. The intertidal mudflats and sandflats and the saltmarsh are highly sensitive to removal by land reclamation and major construction activities.

Eelgrass beds (which are a food source for some species of the assemblage) are being affected by siltation due to changes in sediment movement after construction of the Second Severn Crossing which has resulted in smothering.

ii. Changes in suspended sediment

It is thought unlikely that changes in the suspended sediment within the Estuary will affect the waterfowl assemblage directly but such changes may have marked effects on the supporting habitats on which they are dependant for roosting and feeding.. (Refer also to sections 5.6.1, 5.6.3 and 5.6.4). The supporting habitats are all are currently considered to have **moderate sensitivity** and **moderate exposure** and therefore **moderate vulnerability** to desiccation and changes in emergence regime. Impacts on the suitability of these habitats may affect the long term survival of individuals (in terms of energy and competition) or alter behavior and patterns of use or distribution.

iii. Desiccation and changes in emergence regime

It is thought unlikely that changes in the emergence regime within the Estuary will affect the waterfowl assemblage directly but such changes may have marked effects on the supporting habitats on which they are dependant for roosting and feeding.. (Refer also to sections 5.6.1, 5.6.3 and 5.6.4). The saltmarshes are currently considered to have **high sensitivity** and **low exposure** and therefore **moderate vulnerability** to desiccation and changes in emergence regime. Impacts on the suitability of these habitats may affect the long term survival of individuals (in terms of energy and competition) or alter behavior and patterns of use or distribution.

iv. Changes in water flow rate

It is thought unlikely that changes in water flow rate within the Estuary will affect the designated bird species of the assemblage directly but such changes may have marked effects on the supporting habitats on which these species are dependant for roosting and feeding. All the supporting habitats are considered to have **moderate sensitivity** and **high exposure** and therefore **high vulnerability** to changes in water flow rate . (Refer also to sections 5.6.1, 5.6.3 and 5.6.4). Impacts on the suitability of these habitats may affect the long term survival of individuals (in terms of energy and competition) or alter behavior and patterns of use or distribution.

v. Changes in wave exposure

It is thought unlikely that changes in wave exposure within the Estuary will affect the designated bird species of the assemblage directly but such changes may have marked effects on the supporting habitats on which these species are dependant for roosting and feeding. All the supporting habitats are considered to have **high sensitivity** and **high exposure** and therefore **high vulnerability** to changes in water flow rate . (Refer also to sections 5.6.1, 5.6.3 and 5.6.4). Impacts on the extent and suitability of these habitats may affect the long term survival of individuals (in terms of energy and competition) or alter behavior and patterns of use or distribution.

vi. Abrasion and physical disturbance

Saltmarsh may be physically damaged from overgrazing or eroded when boats are moored on it and when paths are worn through it to reach moored boats on foot or via vehicles. Currently all supporting habitats are considered to be moderately vulnerable to abrasion. Intertidal habitats are **highly sensitive** to damage by direct and indirect effects of aggregate dredging. The intertidal mudflats and sandflats and the shingle and rocky shore are therefore considered **highly vulnerable** to selective extraction.

vii. Changes in grazing management

The waterfowl assemblage which is in part dependant on the saltmarsh habitats is considered to have **high sensitivity** and **high exposure** and therefore **high vulnerability** to changes in grazing management.

The vegetation composition of saltmarsh habitats can be altered by changes in grazing management. This can affect the palatability of the sward for grazing wildfowl and availability of invertebrate food sources and therefore affect the availability of adequate preferred feeding areas within the SPA. Grazing changes may also

affect the suitability saltmarsh areas as resting and roosting sites for birds where open terrain with low vegetation is an important factor.

viii. Noise or visual disturbance

Overwintering birds are disturbed by sudden movements and sudden noises. This can have the effect of displacing the birds from their feeding grounds. Disturbance can prevent the birds from feeding and in response they either a) decrease their energy intake at their present (disturbed) feeding site through displacement activity, or b) move to an alternative less favoured feeding site. Such a response affects energy budgets and thus survival. There is intermittent disturbance to the internationally important migratory species and the waterfowl assemblage from both the landward and seaward side of the site which has increased in recent years, due to the estuary becoming more populated and the development of all weather recreational pursuits. All supporting habitats are currently **highly vulnerable** to noise and visual disturbance.

ix. Toxic contamination through the introduction of synthetic and/or non-synthetic compounds

Waterfowl are subject to the accumulation of toxins through the food chain or through direct contact with toxic substances when roosting or feeding. Their ability to feed can also be affected by the abundance or change in palatability of their prey caused by toxic contamination. At the moment there is no evidence to show that this is the case on the Severn Estuary, but the estuary is vulnerable to oil spills and there is a continuous discharge of toxins into the estuary, some of which bind to the sediments. This is an area that requires further assessment. The intertidal mudflats and sandflats and the saltmarsh are currently **highly vulnerable** to the introduction of synthetic and non-synthetic compounds.

x. Changes in nutrient loading

Changes in organic or nutrient loading can change the species composition of the plants on the saltmarsh and thus the structure of the sward. Increases in nutrients can cause excessive algal growth on the mudflats, denying the birds access to their invertebrate prey and changing the invertebrate species composition in the sediment. However, high nutrient loads can also be beneficial to some species of birds by increasing the density and size of prey items. Though the water quality has been improved in recent years there are still local areas of concern. On balance, any increase in nutrient loading should be avoided. At present the intertidal mudflats and sandflats are **moderately vulnerable** to this category of operation.

xi. Changes in thermal regime

It is thought unlikely that changes in the thermal regime within the Estuary will affect the designated bird species of the assemblage directly but such changes may have marked effects on the community composition of supporting habitats on which these species are dependant for feeding. The intertidal mudflats and sandflats of the estuary are considered to have **moderate sensitivity** and **moderate exposure** and therefore **moderate vulnerability** to changes in thermal regime. Impacts on these habitats may affect the long term survival of individuals (in terms of energy and competition) or alter behavior and patterns of use or distribution.

xii. Changes in salinity

It is thought unlikely that changes in salinity within the Estuary will affect the waterfowl assemblage feature directly but such changes may have marked effects on the supporting habitats on which these species are dependant for feeding. The saltmarshes, intertidal mudflats and sand flats and hard substrate habitats (rocky shores) of the estuary are considered to have **low to moderate sensitivity** and **high exposure** and therefore **moderate to high vulnerability** to changes in salinity. Impacts on these habitats may affect the long term survival of individuals (in terms of energy and competition) or alter behavior and patterns of use or distribution.

xiii. Changes in oxygenation

It is thought unlikely that changes in oxygenation within the Estuary will affect the waterfowl assemblage feature directly but such changes may have marked effects on the community composition of supporting habitats on which these species are dependant for feeding. The saltmarshes, intertidal mudflats and sand flats and hard substrate habitats (rocky shores) of the estuary are considered to have **low sensitivity** and **high exposure** and therefore **moderate vulnerability** to changes in oxygenation. Impacts on these habitats may affect the long term survival of individuals (in terms of energy and competition) or alter behavior and patterns of use or distribution.

xiv. Introduction of microbial pathogens

The bird assemblage is considered to have **low to high sensitivity** and **high exposure** (due to the high number of sewage discharges) and therefore **moderate vulnerability** to the introduction of microbial pathogens.

Microbial pathogens are most likely to enter the Severn's ecosystem by means of sewage discharges. Waterfowl may be affected by microbial pathogens (bacteria or viruses) on their feeding or roosting grounds and are considered to be particularly highly exposed when feeding and roosting on the intertidal mudflats and sandflats and hard substrate habitats where there may be bioaccumulation of pathogens within food sources (filter feeding organisms). Birds may also be affected by direct infection by pathogens present in the water or river sediments and through the release of endo or exotoxins bacterial toxins. Infection may cause mortality, loss of condition and behavioural changes in individuals and within the population using the site through onward contamination.

xv. Introduction of non-native species

The birds assemblage is considered to have **high sensitivity** and **low exposure** and therefore **moderate vulnerability** to the introduction of non native species.

The saltmarsh cordgrass *Spartina anglica* is an invasive pioneer species whose rapid growth consolidates sediment, raises mudflats and reduces sediment availability elsewhere. This expansion can affect areas of intertidal habitats (mud and sandflats and hard substrate habitats) which are key habitats for roosting and feeding birds. Such expansion is regarded as being a potential threat to intertidal beds of eelgrass *Zostera noltei* in particular which are a food source for some species within the assemblage (Wigeon and European white-fronted goose). However, whilst recognising *S. anglica* as an invasive species, it also has a role in saltmarsh formation and the community SM6 in which it features should be allowed to develop into other Atlantic Salt Meadow or transitional communities which are also of value as feeding and roosting habitats for birds within the assemblage.

The presence of another non-native, the slipper limpet *Crepidula fornicata*, in large numbers may alter the species composition within certain soft mud habitats leading to a decline in overall species richness and consequent implications on food availability for feeding birds. However, *C. fornicata* has yet to penetrate the Estuary, possibly due to the strong water flows.

xvi. Selective extraction of species

The birds assemblage is considered to have **moderate sensitivity** and **moderate exposure** and therefore **moderate vulnerability** to the selective extraction of species.

Wildfowling is carried out all around the estuary. It is believed that there is currently no direct detrimental effect on the overall bird populations but wildfowling is one of many activities that may be contributing (through disturbance) to the decline in some species on the Severn. Continuing monitoring and regulation of wildfowling is achieved by the countryside agencies and through the management of wildfowling by a British Association of Shooting and Conservation (BASC) affiliated associations, applying the BASC wildfowlers code of conduct.

Bait digging is also carried out in localised areas of the mid and outer estuary. Extensive areas of digging can change the availability of prey in the sediment as the area needs a period of recovery and recolonisation. There is currently no evidence that existing levels of activity is detrimental to the birds on the European Marine Site.

The removal of strandline vegetation by beach cleaning removes an important habitat for invertebrates, as well as many of the invertebrates themselves, reducing the quantity and variety of prey available to the birds. Much of the saltmarsh is managed by grazing and changes in management can alter the availability of prey and suitability of roosting sites.

Table 23 Sensitivity, exposure and vulnerability of the Severn Estuary SPA to physical, chemical and biological pressures (See note in section 5.7 on changes to this table since version issued in 1995.)

Sensitivity		Exposure		Vulnerability	
High sensitivity	OOOO	High Exposure	x x x x	High vulnerability	⊗⊗⊗⊗ ⊗⊗⊗O ⊗⊗⊗x
Moderate sensitivity	OOO	Medium Exposure	x x x	Moderate vulnerability	⊗⊗OO ⊗⊗x x ⊗⊗⊗
Low sensitivity	OO	Low Exposure	x x	Low vulnerability	⊗⊗O ⊗xxx ⊗⊗x ⊗xx ⊗⊗ ⊗x
No detectable sensitivity	O	No exposure	x	No vulnerability	⊗O
?S =Insufficient information on sensitivity				Unknown vulnerability	

Categories of operations which may cause deterioration or disturbance	Internationally important populations of regularly occurring Annex 1 species		Internationally important migratory species and waterfowl assemblage		
	Intertidal mudflats and sandflats	Saltmarsh	Intertidal mudflats and sandflats	Saltmarsh	Hard substrates
Physical Loss					
Removal/substratum loss	⊗⊗⊗⊗	⊗⊗⊗⊗	⊗⊗⊗⊗	⊗⊗⊗⊗	⊗⊗⊗⊗
Smothering	⊗⊗⊗	⊗⊗⊗	⊗⊗⊗	⊗⊗⊗	⊗⊗⊗
Physical Damage					
Changes in suspended sediment	⊗⊗⊗	⊗⊗⊗	⊗⊗⊗	⊗⊗⊗	⊗⊗⊗
Desiccation and changes in emergence regime	⊗⊗O	⊗⊗OO	⊗⊗O	⊗⊗OO	⊗⊗O
Changes in water flow	⊗⊗⊗x	⊗⊗⊗x	⊗⊗⊗x	⊗⊗⊗x	⊗⊗⊗x
Changes in wave exposure	⊗⊗⊗⊗	⊗⊗⊗⊗	⊗⊗⊗⊗	⊗⊗⊗⊗	⊗⊗⊗⊗
Abrasion / physical disturbance (of habitats)	⊗⊗	⊗⊗O	⊗⊗⊗⊗	⊗⊗⊗x	⊗⊗⊗x
Grazing management	Not relevant	⊗⊗⊗⊗	Not relevant	⊗⊗⊗⊗	Not relevant
Non-physical disturbance					
Noise & visual presence	⊗⊗OO	⊗⊗⊗O	⊗⊗⊗O	⊗⊗⊗⊗	⊗⊗⊗O
Toxic contamination					
Introduction of synthetic compounds	⊗⊗⊗	⊗⊗⊗	⊗⊗⊗⊗	⊗⊗⊗x	⊗⊗⊗x
Introduction of non-synthetic compounds	⊗⊗⊗	⊗⊗⊗	⊗⊗⊗⊗	⊗⊗⊗⊗	⊗⊗⊗x
Introduction of radionuclides	?Sxx	?Sxx	?Sxx	?Sxx	?Sxx
Non-toxic contamination					
Changes in nutrient loading	⊗xxx	⊗⊗⊗x	⊗⊗⊗x	⊗⊗⊗x	⊗⊗xx
Changes in thermal regime	⊗x	⊗⊗	⊗⊗⊗	⊗⊗	⊗⊗
Changes in turbidity (light penetration)	⊗xx	⊗x	⊗⊗x	⊗x	⊗⊗x
Changes in salinity	⊗xxx	⊗⊗⊗x	⊗⊗xx	⊗⊗⊗x	⊗⊗xx
Changes in oxygenation	⊗xxx	⊗⊗xx	⊗⊗xx	⊗⊗xx	⊗⊗xx
Biological disturbance					
Introduction of microbial pathogens	⊗⊗xx	⊗⊗xx	⊗⊗⊗⊗	⊗⊗xx	⊗⊗⊗⊗
Introduction of non-native species	⊗x	⊗⊗	⊗⊗OO	⊗⊗	⊗⊗OO
Selective extraction of species	⊗⊗O	⊗⊗O	⊗⊗⊗	⊗⊗⊗	⊗xx

5.8 Specific Advice on Operations for the Severn Estuary Ramsar Site

Separate advice for the Ramsar Site features has not been produced here as it repeats the advice given in the previous sections (5.6 and 5.7) for the SAC and SPA respectively due to the overlapping nature of the Ramsar features. The following table therefore cross references the features of these designations and provides a direct reference to the section where advice relevant to the Ramsar features can be found.

Table 24 Cross reference table relating features of the Ramsar Site to the advice on operations for the SAC and SPA

Ramsar interest features	Relevant SAC and SPA features and supporting habitats	Reference section for advice on operations relevant to the Ramsar features
<i>Ramsar Interest feature 1 : Estuaries</i>	SAC: Annex I habitats Estuaries Intertidal mudflats and sandflats Atlantic Salt Meadows	Section 5.6..1 & Table 22 Section 5.6.3 & Table 22 Section 5.6.4 & Table 22
<i>Ramsar Interest feature 2 : Migratory fish assemblage</i>	SAC : Annex II species River lamprey <i>Lampetra fluviatilis</i> ; Sea lamprey <i>Petromyzon marinus</i> ; Twaite shad <i>Alosa fallax</i>	Section 5.6.6 & Table 22 Section 5.6.6 & Table 22 Section 5.6.6 & Table 22
Internationally important populations of waterfowl <i>Ramsar Interest feature 3: Bewick's swan</i> <i>Ramsar Interest feature 4: European white-fronted goose</i> <i>Ramsar Interest feature 5: Dunlin</i> <i>Ramsar Interest feature 6: Redshank</i> <i>Ramsar Interest feature 7: Shelduck</i> <i>Ramsar Interest feature 8: Gadwall</i>	SPA : Internationally important populations of regularly occurring Annex 1 species (Bewick's swan) SPA: Internationally important populations of regularly occurring migratory species (same species as column to left) Supporting habitats Intertidal mudflats and sandflats Saltmarsh Hard substrates .	Section 5.7.1 & Table 23 Section 5.7.2 & Table 23 Section 5.6.3 & Table 22 Section 5.6.4 & Table 22
<i>Ramsar Interest feature 9</i> Internationally important assemblage of waterfowl	SPA: Internationally important assemblage of waterfowl Supporting habitats Intertidal mudflats and sandflats Saltmarsh Hard substrates	Section 5.7.2 & Table 23 Section 5.6.3 & Table 22 Section 5.6.4 & Table 22

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7. Glossary

Advisory Group	The body of the representatives from local interests, user groups and conservation groups, formed to advise the management group
Annex 1 Bird species	The species listed in Annex 1 of the Birds Directive are the subject of special conservation measures concerning their habitat. These measures ensure the survival and reproduction of the birds in their area of distribution. Species listed on Annex 1 are in danger of extinction, rare or vulnerable
Annex I habitat type(s)	A natural habitat(s) listed in Annex I of the Habitats Directive for which Special Areas of Conservation can be selected.
Annex II species	A species listed in Annex II of the Habitats Directive for which Special Areas of Conservation can be selected.
Annex V	The listing, in the Habitats Directive, of the animal and plant species whose taking in the wild and exploitation may be subject to management measures.
Assemblage	A collection of plants and/or animals characteristically associated with a particular environment.
Attribute	Characteristic of an interest feature or supporting habitat which provides an indication of the condition of the feature or supporting habitat to which it applies.
BASC	British Association of Shooting and Conservation
Benthos	Those organisms attached to, or living on, in or near, the seabed, including that part which is exposed by tides.
Birds Directive	The abbreviated term of <i>Council Directive 79/409/EEC of 1979 on the conservation of wild birds</i> .
Biodiversity	The total variety of life on earth. This includes diversity within species, between species and ecosystems.
Biotope	The physical habitat with its biological community; a term which refers to the combination of physical environment and its distinctive assemblage of conspicuous species.
BTO	British Trust for Ornithology
CCW	Countryside Council for Wales
Characteristic	Special to, or especially abundant in, a particular situation or biotope. Characteristic species should be immediately conspicuous and easily identified.
Community	A group or organisms occurring in a particular environment, presumably interacting with each other and with the environment, and identifiable by means of ecological survey from other groups.
Competent authority	Any Minister, government department, public or statutory undertaker, public body or person holding a public office that exercises legislative powers.
Conservation objective	A statement of the nature conservation aspirations for a site, expressed in terms of the favourable condition that we wish to see the species and/or habitats for which the site has been selected to attain. Conservation objectives for European Marine Sites relate to the aims of the Habitats Directive.
DEFRA	Department for Environment, Food and Rural Affairs
DETR	Department of the Environment, Transport and the Regions
Epifauna	Benthic animals living on the seabed.
EN	English Nature (now incorporated into Natural England).
Eulittoral	The main part of the intertidal zone characterised by limpets, barnacles, mussels, furoid algae and with red algae often abundant on the lower part.

European Marine Site	A European site which consists of, or in so far as it consists of, areas covered intermittently or continuously by seawater.
European Site	A classified SPA, designated SAC, site of Community importance (a site selected as a candidate SAC, adopted by the European Commission but not yet designated), a candidate SAC (in England only) or a site hosting a priority species in respect of which Article 5 of the Habitats directive applies.
Favourable condition	The condition represented by the achievement of the conservation objectives, in other words the desired condition for a designated habitat or a species on an individual site.
Favourable conservation status (FCS)	A range of conditions for a natural habitat or species at which the sum of the influences acting upon that habitat or species are not adversely affecting its distribution, abundance, structure or function throughout the EC in the long term. The condition in which the habitat or species is capable of sustaining itself on a long-term basis.
Habitat	The place in which a plant or animal lives.
Habitats Directive	The abbreviated term of <i>Council Directive 92/43/EEC of 21 May 1992 on the Conservation of Natural Habitats and of Wild Fauna and Flora</i> . It is the aim of this Directive to promote the conservation of certain habitats and species within the European Union.
Habs Regs	The Conservation (Natural Habitats &c.) Regulations 1994.
HAT	Highest Astronomical Tide.
Infauna	Benthic animals which live within the sediment.
Infralittoral	The subtidal zone in which upward facing rocks are dominated by erect algae, typically kelps.
Interest feature	A natural or semi-natural feature for which a European site has been selected. This includes any Habitats Directive Annex I habitat, or any Annex II species and any population of a bird species for which an SPA has been designated under the Birds Directive.
JNCC	Joint Nature Conservation Committee.
Maintain	The action required for an interest feature when it is considered to be in favourable condition.
Management group	The body of relevant authorities formed to manage the European Marine Site.
Management scheme	The framework established by the relevant authorities at a European Marine Site under which their functions are exercised to secure, in relation to that site, compliance with the requirements of the Habitats Directive.
MNR	Marine Nature Reserve.
Nationally scarce/rare Natura 2000	For marine purposes, these are regarded as species of limited national occurrence. The European network of protected sites established under the Birds Directive and the Habitats Directive.
NNR	National Nature Reserve.
Notable species	A species that is considered to be notable due to its importance as an indicator, and may also be of nature conservation importance, and which is unlikely to be a 'characteristic species.'
Operations which may cause deterioration or disturbance	Any activity or operation taking place within, adjacent to, or remote from a European Marine Site that has the potential to cause deterioration to the natural habitats for which the site was designated, or disturbance to the species and its habitats for which the site was designated.
PCB	Polychlorinated Biphenyls.

Peak mean counts (5 yr)	The Severn Estuary is broken down into count sectors. Over the winter months WeBS volunteers count all the birds which are visible within each sector. The yearly figures for each species in the Severn Estuary are then averaged over a five year period to give the 5 yr peak mean count.
Plan or project	Any operation that is within a competent authority's (including relevant authorities) function to control, or over which a competent authority (including relevant authorities) has a statutory function to decide on applications for consents, authorisations, licences or permissions. There is no generally accepted definition of the term "plan or project". This definition may be subject to review and may require further discussion in the context of developing a management scheme for the Severn Estuary SPA.
Ramsar	Site designated under the 1971 Ramsar Convention as a wetland of international importance.
Relevant authority	The specific competent authority which has powers or functions which have, or could have, an impact on the marine environment, or adjacent to, a European Marine Site.
Reporting period	The cycle within which a definitive report on the condition of features protected within the site series will be produced, set as once in every 6 years.
Restore	The action required for an interest feature when it is not considered to be in a favourable condition.
SAC	Special Area of Conservation.
Sensitivity	The intolerance of a habitat, community or individual species to damage from an external force.
SPA	Special Protection Area for birds.
SSSI	Site of Special Scientific Interest.
Strandline	The organic matter particularly rotting seaweed deposited by the tide anywhere along the intertidal.
Supporting Habitats	The key habitats within the European Marine Site necessary to support the interest feature.
TAN 5	Planning Guidance (Wales) Technical Advice Note (TAN)5: Nature Conservation and Planning (Welsh Assembly Government)
TBT	Tri-butyl tin
Vulnerability	The exposure of a habitat, community or individual of a species to an external factor to which it is sensitive.
WeBS	Wetland Bird Survey: a collaborative national surveillance scheme of the UK's waterfowl based on counts undertaken once per month outside of the breeding season.
WWT	Wildfowl & Wetlands Trust

NATURA 2000 – STANDARD DATA FORM

Special Areas of Conservation under the EC Habitats Directive (includes candidate SACs, Sites of Community Importance and designated SACs).

Each Natura 2000 site in the United Kingdom has its own Standard Data Form containing site-specific information. The data form for this site has been generated from the Natura 2000 Database submitted to the European Commission on the following date:

22/12/2015

The information provided here, follows the officially agreed site information format for Natura 2000 sites, as set out in the [Official Journal of the European Union recording the Commission Implementing Decision of 11 July 2011](#) (2011/484/EU).

The Standard Data Forms are generated automatically for all of the UK's Natura 2000 sites using the European Environment Agency's Natura 2000 software. The structure and format of these forms is exactly as produced by the EEA's Natura 2000 software (except for the addition of this coversheet and the end notes). The content matches exactly the data submitted to the European Commission.

Please note that these forms contain a number of codes, all of which are explained either within the data forms themselves or in the end notes.

Further technical documentation may be found here
http://bd.eionet.europa.eu/activities/Natura_2000/reference_portal

As part of the December 2015 submission, several sections of the UK's previously published Standard Data Forms have been updated. For details of the approach taken by the UK in this submission please refer to the following document:
http://jncc.defra.gov.uk/pdf/Natura2000_StandardDataForm_UKApproach_Dec2015.pdf

More general information on Special Areas of Conservation (SACs) in the United Kingdom is available from the [SAC home page on the JNCC website](#). This webpage also provides links to Standard Data Forms for all SACs in the UK.

Date form generated by the Joint Nature Conservation Committee
25 January 2016.



NATURA 2000 - STANDARD DATA FORM

For Special Protection Areas (SPA),
Proposed Sites for Community Importance (pSCI),
Sites of Community Importance (SCI) and
for Special Areas of Conservation (SAC)

SITE UK0030109
SITENAME Cardiff Beech Woods

TABLE OF CONTENTS

- [1. SITE IDENTIFICATION](#)
- [2. SITE LOCATION](#)
- [3. ECOLOGICAL INFORMATION](#)
- [4. SITE DESCRIPTION](#)
- [5. SITE PROTECTION STATUS AND RELATION WITH CORINE BIOTOPES](#)
- [6. SITE MANAGEMENT](#)

1. SITE IDENTIFICATION

1.1 Type B	1.2 Site code UK0030109	Back to top
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1.3 Site name

Cardiff Beech Woods

1.4 First Compilation date 2000-10	1.5 Update date 2015-12
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1.6 Respondent:

Name/Organisation: Joint Nature Conservation Committee
Address: Joint Nature Conservation Committee Monkstone House City Road Peterborough PE1 1JY
Email:

Date site proposed as SCI:	2000-10
Date site confirmed as SCI:	2004-12
Date site designated as SAC:	2004-12
National legal reference of SAC designation:	Regulations 11 and 13-15 of the Conservation of Habitats and Species Regulations 2010 (http://www.legislation.gov.uk/uksi/2010/490/contents/made).

2. SITE LOCATION

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2.1 Site-centre location [decimal degrees]:

Longitude

-3.270555556

Latitude

51.53388889

2.2 Area [ha]:

114.45

2.3 Marine area [%]

0.0

2.4 Sitelength [km]:

0.0

2.5 Administrative region code and name

NUTS level 2 code

Region Name

UKL2	East Wales
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2.6 Biogeographical Region(s)

Atlantic (100.0
%)

3. ECOLOGICAL INFORMATION

3.1 Habitat types present on the site and assessment for them

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Annex I Habitat types						Site assessment			
Code	PF	NP	Cover [ha]	Cave [number]	Data quality	A B C D	A B C		
						Representativity	Relative Surface	Conservation	Global
8310 			0.01		M	D			
9130 			51.96		G	B	C	B	B
9180 	X		34.56		G	C	C	B	C
91E0 	X		2.63		G	D			

- **PF:** for the habitat types that can have a non-priority as well as a priority form (6210, 7130, 9430) enter "X" in the column PF to indicate the priority form.
- **NP:** in case that a habitat type no longer exists in the site enter: x (optional)
- **Cover:** decimal values can be entered
- **Caves:** for habitat types 8310, 8330 (caves) enter the number of caves if estimated surface is not available.
- **Data quality:** G = 'Good' (e.g. based on surveys); M = 'Moderate' (e.g. based on partial data with some extrapolation); P = 'Poor' (e.g. rough estimation)

3.2 Species referred to in Article 4 of Directive 2009/147/EC and listed in Annex II of Directive

92/43/EEC and site evaluation for them

Species					Population in the site						Site assessment			
G	Code	Scientific Name	S	NP	T	Size		Unit	Cat.	D.qual.	A B C D	A B C		
						Min	Max				Pop.	Con.	Iso.	Glo.
F	1163	Cottus gobio			p				P	DD	D			
M	1304	Rhinolophus ferrumequinum			p				P	DD	D			
M	1303	Rhinolophus hipposideros			p				P	DD	D			

- **Group:** A = Amphibians, B = Birds, F = Fish, I = Invertebrates, M = Mammals, P = Plants, R = Reptiles
- **S:** in case that the data on species are sensitive and therefore have to be blocked for any public access enter: yes
- **NP:** in case that a species is no longer present in the site enter: x (optional)
- **Type:** p = permanent, r = reproducing, c = concentration, w = wintering (for plant and non-migratory species use permanent)
- **Unit:** i = individuals, p = pairs or other units according to the Standard list of population units and codes in accordance with Article 12 and 17 reporting (see [reference portal](#))
- **Abundance categories (Cat.):** C = common, R = rare, V = very rare, P = present - to fill if data are deficient (DD) or in addition to population size information
- **Data quality:** G = 'Good' (e.g. based on surveys); M = 'Moderate' (e.g. based on partial data with some extrapolation); P = 'Poor' (e.g. rough estimation); VP = 'Very poor' (use this category only, if not even a rough estimation of the population size can be made, in this case the fields for population size can remain empty, but the field "Abundance categories" has to be filled in)

4. SITE DESCRIPTION

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4.1 General site character

Habitat class	% Cover
N23	0.5
N16	99.5
Total Habitat Cover	100

Other Site Characteristics

1 Terrestrial: Soil & Geology: limestone,basic 2 Terrestrial: Geomorphology and landscape: slope, valley, lowland, caves

4.2 Quality and importance

Asperulo-Fagetum beech forests for which this is considered to be one of the best areas in the United Kingdom. Tilio-Acerion forests of slopes, screes and ravines for which the area is considered to support a significant presence.

4.3 Threats, pressures and activities with impacts on the site

The most important impacts and activities with high effect on the site

Negative Impacts			
Rank	Threats and pressures [code]	Pollution (optional) [code]	inside/outside [i o b]

Positive Impacts			
Rank	Activities, management [code]	Pollution (optional) [code]	inside/outside [i o b]
M	k02		I

H	K04		I
M	I01		I
H	G01		B

Rank: H = high, M = medium, L = low

Pollution: N = Nitrogen input, P = Phosphor/Phosphate input, A = Acid input/acidification,

T = toxic inorganic chemicals, O = toxic organic chemicals, X = Mixed pollutions

i = inside, o = outside, b = both

4.5 Documentation

The Natural Resources Wales weblink below provides access to information on its designated sites. Detailed information about this Natura 2000 site can be accessed via the Management Plan link provided in Section 6.2. See also the 'UK Approach' document for more information (link via the JNCC website).

Link(s): http://jncc.defra.gov.uk/pdf/Natura2000_StandardDataForm_UKApproach_Dec2015.pdf

<https://naturalresources.wales/conservation-biodiversity-and-wildlife/find-protected-areas-of-land-and-seas/designated-s>

5. SITE PROTECTION STATUS (optional)

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5.1 Designation types at national and regional level:

Code	Cover [%]	Code	Cover [%]	Code	Cover [%]
UK04	100.0				

6. SITE MANAGEMENT

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6.1 Body(ies) responsible for the site management:

Organisation:	Natural Resources Wales
Address:	
Email:	

6.2 Management Plan(s):

An actual management plan does exist:

☒	Yes	Name: CARDIFF BEECH WOODS
	Link:	https://www.naturalresources.wales/media/672066/FINAL%20Cdf%20Beech%20Woods%20SAC%20Man%20Plan.pdf
☐	No, but in preparation	
☐	No	

EXPLANATION OF CODES USED IN THE NATURA 2000 STANDARD DATA FORMS

The codes in the table below are also explained in the [official European Union guidelines for the Standard Data Form](#). The relevant page is shown in the table below.

1.1 Site type

CODE	DESCRIPTION	PAGE NO
A	Designated Special Protection Area	53
B	SAC (includes candidates Special Areas of Conservation, Sites of Community Importance and designated SAC)	53
C	SAC area the same as SPA. Note in the UK Natura 2000 submission this is only used for Gibraltar	53

3.1 Habitat representativity

CODE	DESCRIPTION	PAGE NO
A	Excellent	57
B	Good	57
C	Significant	57
D	Non-significant presence	57

3.1 Habitat code

CODE	DESCRIPTION	PAGE NO
1110	Sandbanks which are slightly covered by sea water all the time	57
1130	Estuaries	57
1140	Mudflats and sandflats not covered by seawater at low tide	57
1150	Coastal lagoons	57
1160	Large shallow inlets and bays	57
1170	Reefs	57
1180	Submarine structures made by leaking gases	57
1210	Annual vegetation of drift lines	57
1220	Perennial vegetation of stony banks	57
1230	Vegetated sea cliffs of the Atlantic and Baltic Coasts	57
1310	Salicornia and other annuals colonizing mud and sand	57
1320	Spartina swards (Spartinion maritimae)	57
1330	Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	57
1340	Inland salt meadows	57
1420	Mediterranean and thermo-Atlantic halophilous scrubs (Sarcocornetea fruticosi)	57
2110	Embryonic shifting dunes	57
2120	Shifting dunes along the shoreline with Ammophila arenaria ("white dunes")	57
2130	Fixed coastal dunes with herbaceous vegetation ("grey dunes")	57
2140	Decalcified fixed dunes with Empetrum nigrum	57
2150	Atlantic decalcified fixed dunes (Calluno-Ulicetea)	57
2160	Dunes with Hippophila rhamnoides	57
2170	Dunes with Salix repens ssp. argentea (Salicion arenariae)	57
2190	Humid dune slacks	57
21A0	Machairs (* in Ireland)	57
2250	Coastal dunes with Juniperus spp.	57
2330	Inland dunes with open Corynephorus and Agrostis grasslands	57
3110	Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae)	57
3130	Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Isoëto-Nanojuncetea	57
3140	Hard oligo-mesotrophic waters with benthic vegetation of Chara spp.	57
3150	Natural eutrophic lakes with Magnopotamion or Hydrocharition - type vegetation	57

CODE	DESCRIPTION	PAGE NO
3160	Natural dystrophic lakes and ponds	57
3170	Mediterranean temporary ponds	57
3180	Turloughs	57
3260	Water courses of plain to montane levels with the Ranunculion fluitantis and Callitriche-Batrachion vegetation	57
4010	Northern Atlantic wet heaths with Erica tetralix	57
4020	Temperate Atlantic wet heaths with Erica ciliaris and Erica tetralix	57
4030	European dry heaths	57
4040	Dry Atlantic coastal heaths with Erica vagans	57
4060	Alpine and Boreal heaths	57
4080	Sub-Arctic Salix spp. scrub	57
5110	Stable xerothermophilous formations with Buxus sempervirens on rock slopes (Berberidion p.p.)	57
5130	Juniperus communis formations on heaths or calcareous grasslands	57
6130	Calaminarian grasslands of the Violetalia calaminariae	57
6150	Siliceous alpine and boreal grasslands	57
6170	Alpine and subalpine calcareous grasslands	57
6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites)	57
6230	Species-rich Nardus grasslands, on silicious substrates in mountain areas (and submountain areas in Continental Europe)	57
6410	Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae)	57
6430	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels	57
6510	Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)	57
6520	Mountain hay meadows	57
7110	Active raised bogs	57
7120	Degraded raised bogs still capable of natural regeneration	57
7130	Blanket bogs (* if active bog)	57
7140	Transition mires and quaking bogs	57
7150	Depressions on peat substrates of the Rhynchosporion	57
7210	Calcareous fens with Cladium mariscus and species of the Caricion davallianae	57
7220	Petrifying springs with tufa formation (Cratoneurion)	57
7230	Alkaline fens	57
7240	Alpine pioneer formations of the Caricion bicoloris-atrofuscae	57
8110	Siliceous scree of the montane to snow levels (Androsacetalia alpinae and Galeopsietalia ladani)	57
8120	Calcareous and calcshist screes of the montane to alpine levels (Thlaspietea rotundifolii)	57
8210	Calcareous rocky slopes with chasmophytic vegetation	57
8220	Siliceous rocky slopes with chasmophytic vegetation	57
8240	Limestone pavements	57
8310	Caves not open to the public	57
8330	Submerged or partially submerged sea caves	57
9120	Atlantic acidophilous beech forests with Ilex and sometimes also Taxus in the shrublayer (Quercion roburi-petraeae or Ilici-Fagenion)	57
9130	Asperulo-Fagetum beech forests	57
9160	Sub-Atlantic and medio-European oak or oak-hornbeam forests of the Carpinion betuli	57
9180	Tilio-Acerion forests of slopes, screes and ravines	57
9190	Old acidophilous oak woods with Quercus robur on sandy plains	57
91A0	Old sessile oak woods with Ilex and Blechnum in the British Isles	57
91C0	Caledonian forest	57
91D0	Bog woodland	57
91E0	Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)	57
91J0	Taxus baccata woods of the British Isles	57

3.1 Relative surface

CODE	DESCRIPTION	PAGE NO
A	15%-100%	58
B	2%-15%	58
C	< 2%	58

3.1 Conservation status habitat

CODE	DESCRIPTION	PAGE NO
A	Excellent conservation	59
B	Good conservation	59
C	Average or reduced conservation	59

3.1 Global grade habitat

CODE	DESCRIPTION	PAGE NO
A	Excellent value	59
B	Good value	59
C	Significant value	59

3.2 Population (abbreviated to 'Pop.' in data form)

CODE	DESCRIPTION	PAGE NO
A	15%-100%	62
B	2%-15%	62
C	< 2%	62
D	Non-significant population	62

3.2 Conservation status species (abbreviated to 'Con.' in data form)

CODE	DESCRIPTION	PAGE NO
A	Excellent conservation	63
B	Good conservation	63
C	Average or reduced conservation	63

3.2 Isolation (abbreviated to 'Iso.' in data form)

CODE	DESCRIPTION	PAGE NO
A	Population (almost) Isolated	63
B	Population not-isolated, but on margins of area of distribution	63
C	Population not-isolated within extended distribution range	63

3.2 Global Grade (abbreviated to 'Glo.' Or 'G.' in data form)

CODE	DESCRIPTION	PAGE NO
A	Excellent value	63
B	Good value	63
C	Significant value	63

3.3 Assemblages types

CODE	DESCRIPTION	PAGE NO
WATR	Non breeding waterfowl assemblage	UK specific code
SBA	Breeding seabird assemblage	UK specific code
BBA	Breeding bird assemblage (applies only to sites classified pre 2000)	UK specific code

4.1 Habitat class code

CODE	DESCRIPTION	PAGE NO
N01	Marine areas, Sea inlets	65
N02	Tidal rivers, Estuaries, Mud flats, Sand flats, Lagoons (including saltwork basins)	65
N03	Salt marshes, Salt pastures, Salt steppes	65
N04	Coastal sand dunes, Sand beaches, Machair	65
N05	Shingle, Sea cliffs, Islets	65
N06	Inland water bodies (Standing water, Running water)	65
N07	Bogs, Marshes, Water fringed vegetation, Fens	65
N08	Heath, Scrub, Maquis and Garrigue, Phygrana	65
N09	Dry grassland, Steppes	65
N10	Humid grassland, Mesophile grassland	65
N11	Alpine and sub-Alpine grassland	65
N14	Improved grassland	65
N15	Other arable land	65
N16	Broad-leaved deciduous woodland	65
N17	Coniferous woodland	65
N19	Mixed woodland	65
N21	Non-forest areas cultivated with woody plants (including Orchards, groves, Vineyards, Dehesas)	65
N22	Inland rocks, Scree, Sands, Permanent Snow and ice	65
N23	Other land (including Towns, Villages, Roads, Waste places, Mines, Industrial sites)	65
N25	Grassland and scrub habitats (general)	65
N26	Woodland habitats (general)	65

4.3 Threats code

CODE	DESCRIPTION	PAGE NO
A01	Cultivation	65
A02	Modification of cultivation practices	65
A03	Mowing / cutting of grassland	65
A04	Grazing	65
A05	Livestock farming and animal breeding (without grazing)	65
A06	Annual and perennial non-timber crops	65
A07	Use of biocides, hormones and chemicals	65
A08	Fertilisation	65
A10	Restructuring agricultural land holding	65
A11	Agriculture activities not referred to above	65
B01	Forest planting on open ground	65
B02	Forest and Plantation management & use	65
B03	Forest exploitation without replanting or natural regrowth	65
B04	Use of biocides, hormones and chemicals (forestry)	65
B06	Grazing in forests/ woodland	65
B07	Forestry activities not referred to above	65
C01	Mining and quarrying	65
C02	Exploration and extraction of oil or gas	65
C03	Renewable abiotic energy use	65
D01	Roads, paths and railroads	65
D02	Utility and service lines	65
D03	Shipping lanes, ports, marine constructions	65
D04	Airports, flightpaths	65
D05	Improved access to site	65
E01	Urbanised areas, human habitation	65
E02	Industrial or commercial areas	65

CODE	DESCRIPTION	PAGE NO
E03	Discharges	65
E04	Structures, buildings in the landscape	65
E06	Other urbanisation, industrial and similar activities	65
F01	Marine and Freshwater Aquaculture	65
F02	Fishing and harvesting aquatic resources	65
F03	Hunting and collection of wild animals (terrestrial), including damage caused by game (excessive density), and taking/removal of terrestrial animals (including collection of insects, reptiles, amphibians, birds of prey, etc., trapping, poisoning, poaching, predator control, accidental capture (e.g. due to fishing gear), etc.)	65
F04	Taking / Removal of terrestrial plants, general	65
F05	Illegal taking/ removal of marine fauna	65
F06	Hunting, fishing or collecting activities not referred to above	65
G01	Outdoor sports and leisure activities, recreational activities	65
G02	Sport and leisure structures	65
G03	Interpretative centres	65
G04	Military use and civil unrest	65
G05	Other human intrusions and disturbances	65
H01	Pollution to surface waters (limnic & terrestrial, marine & brackish)	65
H02	Pollution to groundwater (point sources and diffuse sources)	65
H03	Marine water pollution	65
H04	Air pollution, air-borne pollutants	65
H05	Soil pollution and solid waste (excluding discharges)	65
H06	Excess energy	65
H07	Other forms of pollution	65
I01	Invasive non-native species	65
I02	Problematic native species	65
I03	Introduced genetic material, GMO	65
J01	Fire and fire suppression	65
J02	Human induced changes in hydraulic conditions	65
J03	Other ecosystem modifications	65
K01	Abiotic (slow) natural processes	65
K02	Biocenotic evolution, succession	65
K03	Interspecific faunal relations	65
K04	Interspecific floral relations	65
K05	Reduced fecundity/ genetic depression	65
L05	Collapse of terrain, landslide	65
L07	Storm, cyclone	65
L08	Inundation (natural processes)	65
L10	Other natural catastrophes	65
M01	Changes in abiotic conditions	65
M02	Changes in biotic conditions	65
U	Unknown threat or pressure	65
XO	Threats and pressures from outside the Member State	65

5.1 Designation type codes

CODE	DESCRIPTION	PAGE NO
UK00	No Protection Status	67
UK01	National Nature Reserve	67
UK02	Marine Nature Reserve	67
UK04	Site of Special Scientific Interest (UK)	67

NATURA 2000

STANDARD DATA FORM

FOR SPECIAL PROTECTION AREAS (SPA)
FOR SITES ELIGIBLE FOR IDENTIFICATION AS SITES OF COMMUNITY IMPORTANCE (SCI)
AND
FOR SPECIAL AREAS OF CONSERVATION (SAC)

1. Site identification:

1.1 Type

1.2 Site code

1.3 Compilation date

1.4 Update

1.5 Relationship with other Natura 2000 sites

U	K	0	0	1	2	6	4	2
U	K	0	0	1	3	0	0	7
U	K	0	0	1	3	0	3	0
U	K	0	0	3	0	2	0	3

1.6 Respondent(s)

1.7 Site name

1.8 Site indication and designation classification dates

date site proposed as eligible as SCI	
date confirmed as SCI	
date site classified as SPA	199507
date site designated as SAC	

2. Site location:

2.1 Site centre location

longitude	latitude
03 02 57 W	51 13 29 N

2.2 Site area (ha)

2.3 Site length (km)

2.5 Administrative region

NUTS code	Region name	% cover
UK611	Avon	25.04%
UK612	Gloucestershire	21.03%
UK921	Gwent	26.04%
UK632	Somerset	24.04%
UK923	South Glamorgan	4.01%

2.6 Biogeographic region

☐ Alpine

☒ Atlantic

☐ Boreal

☐ Continental

☐ Macaronesia

☐ Mediterranean

3. Ecological information:

3.1 Annex I habitats

Habitat types present on the site and the site assessment for them:

Annex I habitat	% cover	Representativity	Relative surface	Conservation status	Global assessment

3.2 Annex I birds and regularly occurring migratory birds not listed on Annex I

		Population				Site assessment			
		Resident	Migratory			Population	Conservation	Isolation	Global
Code	Species name		Breed	Winter	Stage				
A051	<i>Anas strepera</i>			282 I		B		C	
A041a	<i>Anser albifrons albifrons</i>			2664 I		A		B	
A149	<i>Calidris alpina alpina</i>			44624 I		B		C	
A037	<i>Cygnus columbianus bewickii</i>			280 I		B		C	
A048	<i>Tadorna tadorna</i>			3330 I		B		C	
A162	<i>Tringa totanus</i>			2330 I		B		C	

4. Site description:

4.1 General site character

Habitat classes	% cover
Marine areas. Sea inlets	
Tidal rivers. Estuaries. Mud flats. Sand flats. Lagoons (including saltwork basins)	89.0
Salt marshes. Salt pastures. Salt steppes	6.0
Coastal sand dunes. Sand beaches. Machair	4.0
Shingle. Sea cliffs. Islets	
Inland water bodies (standing water, running water)	
Bogs. Marshes. Water fringed vegetation. Fens	
Heath. Scrub. Maquis and garrigue. Phygrana	
Dry grassland. Steppes	
Humid grassland. Mesophile grassland	
Alpine and sub-alpine grassland	
Improved grassland	1.0
Other arable land	
Broad-leaved deciduous woodland	
Coniferous woodland	
Evergreen woodland	
Mixed woodland	
Non-forest areas cultivated with woody plants (including orchards, groves, vineyards, dehesas)	
Inland rocks. Scree. Sands. Permanent snow and ice	
Other land (including towns, villages, roads, waste places, mines, industrial sites)	
Total habitat cover	100%

4.1 Other site characteristics

Soil & geology:

Biogenic reef, Clay, Cobble, Gravel, Limestone/chalk, Mud, Peat, Sand, Sandstone/mudstone, Sedimentary, Shingle

Geomorphology & landscape:

Cliffs, Estuary, Intertidal rock, Intertidal sediments (including sandflat/mudflat), Islands, Open coast (including bay), Pools, Subtidal rock (including rocky reefs), Subtidal sediments (including sandbank/mudbank), Tidal rapids

4.2 Quality and importance

ARTICLE 4.1 QUALIFICATION (79/409/EEC)

Over winter the area regularly supports:

<i>Cygnus columbianus bewickii</i> (Western Siberia/North-eastern & North-western Europe)	3.9% of the GB population 5 year peak mean 1991/92-1995/96
--	---

ARTICLE 4.2 QUALIFICATION (79/409/EEC)

Over winter the area regularly supports:

<i>Anas strepera</i> (North-western Europe)	0.9% of the population 5 year peak mean 1991/92-1995/96
<i>Anser albifrons albifrons</i> (North-western Siberia/North-eastern & North-western Europe)	0.4% of the population 5 year peak mean 1991/92-1995/96
<i>Calidris alpina alpina</i> (Northern Siberia/Europe/Western Africa)	3.3% of the population 5 year peak mean 1991/92-1995/96
<i>Tadorna tadorna</i> (North-western Europe)	1.1% of the population 5 year peak mean 1991/92-1995/96
<i>Tringa totanus</i> (Eastern Atlantic - wintering)	1.3% of the population 5 year peak mean 1991/92-1995/96

ARTICLE 4.2 QUALIFICATION (79/409/EEC): AN INTERNATIONALLY IMPORTANT ASSEMBLAGE OF BIRDS

Over winter the area regularly supports:

84317 waterfowl (5 year peak mean 01/04/1998)

Including:

Cygnus columbianus bewickii , *Anser albifrons albifrons* , *Tadorna tadorna* , *Anas strepera* , *Calidris alpina alpina* , *Tringa totanus* .

4.3 Vulnerability

The conservation of the site features is dependent on the tidal regime. The range is the second highest in the world and the scouring of the seabed and strong tidal streams result in natural erosion of the habitats. The estuary is therefore vulnerable to large scale interference, including human actions. These include land-claim, aggregate extraction/dredging, physical developments such as barrage construction flood defences, pollution (industrial, oil spillage), eutrophication and tourism based activities and disturbance. These issues are being addressed through existing control measures and as part of the Severn Estuary Strategy.

Since June 1995 the Severn Estuary Strategy has been working towards the sustainable management of the site, through the involvement of local authorities, interested parties and local people. This integrated approach is being further developed in conjunction with the SAC management scheme for the nature conservation interest of the estuary.

5. Site protection status and relation with CORINE biotopes:

5.1 Designation types at national and regional level

Code	% cover
UK01 (NNR)	9.0
UK04 (SSSI/ASSI)	100.2

NATURA 2000

STANDARD DATA FORM

FOR SPECIAL PROTECTION AREAS (SPA)

FOR SITES ELIGIBLE FOR IDENTIFICATION AS SITES OF COMMUNITY IMPORTANCE (SCI)

AND

FOR SPECIAL AREAS OF CONSERVATION (SAC)

1. Site identification:

1.1 Type

K

1.2 Site code

UK0013030

1.3 Compilation date

200708

1.4 Update

1.5 Relationship with other Natura 2000 sites

U	K	9	0	1	5	0	2	2
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1.6 Respondent(s)

International Designations, JNCC, Peterborough

1.7 Site name

Severn Estuary/ Môr Hafren

1.8 Site indication and designation classification dates

date site proposed as eligible as SCI	200708
date confirmed as SCI	200812
date site classified as SPA	
date site designated as SAC	201012

2. Site location:

2.1 Site centre location

longitude

latitude

02 58 41 W

51 28 07 N

2.2 Site area (ha)

73715.4

2.3 Site length (km)

2.5 Administrative region

NUTS code	Region name	% cover
UKL22	Cardiff and Vale of Glamorgan	1.02%
UKL21	Monmouthshire and Newport	8.39%
UKK13	Gloucestershire	6.10%
UKK11	Bristol, City of	16.92%
UKK12	North and North East Somerset, South Gloucestershire	8.12%
UKK23	Somerset	7.27%
0	Marine	52.18%

2.6 Biogeographic region

☐

Alpine

☒

Atlantic

☐

Boreal

☐

Continental

☐

Macaronesia

☐

Mediterranean

3. Ecological information:

3.1 Annex I habitats

Habitat types present on the site and the site assessment for them:

Annex I habitat	% cover	Representativity	Relative surface	Conservation status	Global assessment
Sandbanks which are slightly covered by sea water all the time	15.98	C	C	B	C
Estuaries	99.95	A	A	B	B
Mudflats and sandflats not covered by seawater at low tide	27.5	A	B	B	B
Reefs	2	C	C	A	C
<i>Salicornia</i> and other annuals colonising mud and sand	0	D			
<i>Spartina</i> swards (<i>Spartinion maritimae</i>)	0.26	D			
Atlantic salt meadows (<i>Glauco-Puccinellietalia maritimae</i>)	0.89	A	B	B	A
Embryonic shifting dunes	0	D			

3.2 Annex II species

Species name	Population				Site assessment			
	Resident	Migratory			Population	Conservation	Isolation	Global
		Breed	Winter	Stage				
<i>Petromyzon marinus</i>	Common	-	-	-	C	A	C	B
<i>Lampetra fluviatilis</i>	Common	-	-	-	C	B	C	B
<i>Alosa alosa</i>	Very rare	-	-	-	D			
<i>Alosa fallax</i>	Common	-	-	-	A	B	C	A

4. Site description

4.1 General site character

Habitat classes	% cover
Marine areas. Sea inlets	
Tidal rivers. Estuaries. Mud flats. Sand flats. Lagoons (including saltwork basins)	99.0
Salt marshes. Salt pastures. Salt steppes	1.0
Coastal sand dunes. Sand beaches. Machair	
Shingle. Sea cliffs. Islets	
Inland water bodies (standing water, running water)	
Bogs. Marshes. Water fringed vegetation. Fens	
Heath. Scrub. Maquis and garrigue. Phygrana	
Dry grassland. Steppes	
Humid grassland. Mesophile grassland	
Alpine and sub-alpine grassland	
Improved grassland	
Other arable land	
Broad-leaved deciduous woodland	
Coniferous woodland	
Evergreen woodland	
Mixed woodland	
Non-forest areas cultivated with woody plants (including orchards, groves, vineyards, dehesas)	
Inland rocks. Scree. Sands. Permanent snow and ice	
Other land (including towns, villages, roads, waste places, mines, industrial sites)	

Habitat classes	% cover
Total habitat cover	100%

4.1 Other site characteristics

Soil & geology:

Biogenic reef, Clay, Cobble, Gravel, Limestone/chalk, Mud, Peat, Pebble, Sand, Sandstone/mudstone, Sedimentary, Shingle

Geomorphology & landscape:

Cliffs, Coastal, Estuary, Intertidal rock, Intertidal sediments (including sandflat/mudflat), Islands, Open coast (including bay), Pools, Subtidal rock (including rocky reefs), Subtidal sediments (including sandbank/mudbank), Tidal rapids

4.2 Quality and importance

Sandbanks which are slightly covered by sea water all the time

- for which the area is considered to support a significant presence.

Estuaries

- for which this is considered to be one of the best areas in the United Kingdom.

Mudflats and sandflats not covered by seawater at low tide

- for which this is considered to be one of the best areas in the United Kingdom.

Reefs

- for which the area is considered to support a significant presence.

Atlantic salt meadows (*Glauco-Puccinellietalia maritima*)

- for which this is considered to be one of the best areas in the United Kingdom.

Petromyzon marinus

- for which this is considered to be one of the best areas in the United Kingdom.

Lampetra fluviatilis

- for which this is considered to be one of the best areas in the United Kingdom.

Alosa fallax

- for which this is considered to be one of the best areas in the United Kingdom.

4.3 Vulnerability

The conservation of the site features is dependent on the tidal regime. The tidal range in the Severn Estuary is the second-highest in the world and the scouring of the seabed and strong tidal streams result in natural erosion of the habitats and the presence of high sediment loads. The estuary is therefore vulnerable to large-scale interference, mainly as a result of human actions. These include land-claim, aggregate extraction, physical developments such as barrage construction and other commercial construction activities, flood defences, industrial pollution, oil spillage and tourism-based activities and disturbance.

There are several management mechanisms that seek to secure sustainable management of the Severn Estuary and its wildlife interest. Under the 1994 Habitats Regulations, a management scheme under Regulation 34 was established in 2004 in relation to the international bird interest that underpins designation as a Special Protection Area (SPA). Conservation advice has been provided under Regulation 33 for the Severn Estuary Special Area of Conservation (SAC), SPA and Ramsar site. Under the 2010 Habitat Regulations the management scheme previously produced is being reviewed and expanded to cover the not only the SPA but also the SAC and Ramsar site. The Severn Estuary Partnership is a long-standing partnership whose remit and membership extends beyond the designated area. It predates the European designations and seeks to deliver holistic management of the uses of the estuary. In Wales, Community Strategies and Local Biodiversity Action Plans also contribute to achieving the conservation aims for the Estuary.

5. Site protection status and relation with CORINE biotopes:

5.1 Designation types at national and regional level

Code	% cover
UK01 (NNR)	3.4

UK SAC data form

UK00 (N/A)	77.3
UK04 (SSSI/ASSI)	22.7

Information Sheet on Ramsar Wetlands (RIS)

Categories approved by Recommendation 4.7 (1990), as amended by Resolution VIII.13 of the 8th Conference of the Contracting Parties (2002) and Resolutions IX.1 Annex B, IX.6, IX.21 and IX. 22 of the 9th Conference of the Contracting Parties (2005).

Notes for compilers:

1. The RIS should be completed in accordance with the attached *Explanatory Notes and Guidelines for completing the Information Sheet on Ramsar Wetlands*. Compilers are strongly advised to read this guidance before filling in the RIS.
2. Further information and guidance in support of Ramsar site designations are provided in the *Strategic Framework for the future development of the List of Wetlands of International Importance* (Ramsar Wise Use Handbook 7, 2nd edition, as amended by COP9 Resolution IX.1 Annex B). A 3rd edition of the Handbook, incorporating these amendments, is in preparation and will be available in 2006.
3. Once completed, the RIS (and accompanying map(s)) should be submitted to the Ramsar Secretariat. Compilers should provide an electronic (MS Word) copy of the RIS and, where possible, digital copies of all maps.

1. Name and address of the compiler of this form:

Joint Nature Conservation Committee

Monkstone House

City Road

Peterborough

Cambridgeshire PE1 1JY

UK

Telephone/Fax: +44 (0)1733 – 562 626 / +44 (0)1733 – 555 948

Email: RIS@JNCC.gov.uk

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DD MM YY

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Designation date

--	--	--	--	--	--

Site Reference Number

2. Date this sheet was completed/updated:

Designated: 13 July 1995

3. Country:

UK (England/Wales)

4. Name of the Ramsar site:

Severn Estuary

5. Designation of new Ramsar site or update of existing site:

This RIS is for: Updated information on an existing Ramsar site

6. **For RIS updates only,** changes to the site since its designation or earlier update:

a) Site boundary and area:

**** Important note:** If the boundary and/or area of the designated site is being restricted/reduced, the Contracting Party should have followed the procedures established by the Conference of the Parties in the Annex to COP9 Resolution IX.6 and provided a report in line with paragraph 28 of that Annex, prior to the submission of an updated RIS.

b) Describe briefly any major changes to the ecological character of the Ramsar site, including in the application of the Criteria, since the previous RIS for the site:

7. Map of site included:

Refer to Annex III of the *Explanatory Notes and Guidelines*, for detailed guidance on provision of suitable maps, including digital maps.

a) A map of the site, with clearly delineated boundaries, is included as:

- i) **hard copy** (required for inclusion of site in the Ramsar List): yes ✓ -or- no ☐;
- ii) **an electronic format** (e.g. a JPEG or ArcView image) Yes
- iii) **a GIS file providing geo-referenced site boundary vectors and attribute tables** yes ✓ -or- no ☐;

b) Describe briefly the type of boundary delineation applied:

e.g. the boundary is the same as an existing protected area (nature reserve, national park etc.), or follows a catchment boundary, or follows a geopolitical boundary such as a local government jurisdiction, follows physical boundaries such as roads, follows the shoreline of a waterbody, etc.

The site boundary is the same as, or falls within, an existing protected area.

For precise boundary details, please refer to paper map provided at designation

8. Geographical coordinates (latitude/longitude):

51 13 29 N 03 02 57 W

9. General location:

Include in which part of the country and which large administrative region(s), and the location of the nearest large town.

Nearest town/city: Bristol

In the south-west of the United Kingdom, between Wales and England

Administrative region: Bro Morgannwg/ Vale of Glamorgan; Caerdydd/ Cardiff; Casnewydd/ Newport; Avon; City of Bristol; Fynwy/ Monmouthshire; Gloucestershire; Gwent; North Somerset; Somerset; South Glamorgan; South Gloucestershire

10. Elevation (average and/or max. & min.) (metres): **11. Area** (hectares): 24662.98

Min. -4
Max. 17
Mean 0

12. General overview of the site:

Provide a short paragraph giving a summary description of the principal ecological characteristics and importance of the wetland.

The estuary's classic funnel shape, unique in Britain, is a factor causing the Severn to have the second-largest tidal range in the world (after the Bay of Fundy, Canada). This tidal regime results in plant and animal communities typical of the extreme physical conditions of liquid mud and tide swept sand and rock. The species-poor invertebrate community includes high densities of ragworms, lugworms and other invertebrates forming an important food source for passage and wintering waders.

A further consequence of the large tidal range is the extensive intertidal zone, one of the largest in the UK, comprising mudflats, sand banks, shingle, and rocky platforms.

Glassworts and annual sea-blite colonise the open mud, with beds of all three species of eelgrass *Zostera* occurring on more sheltered mud and sandbanks. Large expanses of common cord-grass also occur on the outer marshes. Heavily grazed saltmarsh fringes the estuary with a range of saltmarsh types present. The middle marsh sward is dominated by common saltmarsh-grass with typical associated species. In the upper marsh, red fescue and saltmarsh rush become more prominent.

13. Ramsar Criteria:

Circle or underline each Criterion applied to the designation of the Ramsar site. See Annex II of the *Explanatory Notes and Guidelines* for the Criteria and guidelines for their application (adopted by Resolution VII.11).

1, 3, 4, 5, 6, 8

14. Justification for the application of each Criterion listed in 13 above:

Provide justification for each Criterion in turn, clearly identifying to which Criterion the justification applies (see Annex II for guidance on acceptable forms of justification).

Ramsar criterion 1

Due to immense tidal range (second-largest in world), this affects both the physical environment and biological communities.

Habitats Directive Annex I features present on the pSAC include:

- H1110 Sandbanks which are slightly covered by sea water all the time
- H1130 Estuaries
- H1140 Mudflats and sandflats not covered by seawater at low tide
- H1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritima*)

Ramsar criterion 3

Due to unusual estuarine communities, reduced diversity and high productivity.

Ramsar criterion 4

This site is important for the run of migratory fish between sea and river via estuary. Species include Salmon *Salmo salar*, sea trout *S. trutta*, sea lamprey *Petromyzon marinus*, river lamprey *Lampetra fluviatilis*, allis shad *Alosa alosa*, twaite shad *A. fallax*, and eel *Anguilla anguilla*. It is also of particular importance for migratory birds during spring and autumn.

Ramsar criterion 8

The fish of the whole estuarine and river system is one of the most diverse in Britain, with over 110 species recorded. Salmon *Salmo salar*, sea trout *S. trutta*, sea lamprey *Petromyzon marinus*, river lamprey *Lampetra fluviatilis*, allis shad *Alosa alosa*, twaite shad *A. fallax*, and eel *Anguilla anguilla* use the Severn Estuary as a key migration route to their spawning grounds in the many tributaries that flow into the estuary. The site is important as a feeding and nursery ground for many fish species particularly allis shad *Alosa alosa* and twaite shad *A. fallax* which feed on mysid shrimps in the salt wedge.

Ramsar criterion 5

Assemblages of international importance:

Species with peak counts in winter:

70919 waterfowl (5 year peak mean 1998/99-2002/2003)

Ramsar criterion 6 – species/populations occurring at levels of international importance.

Qualifying Species/populations (as identified at designation):

Species with peak counts in winter:

Tundra swan , <i>Cygnus columbianus bewickii</i> , NW Europe	229 individuals, representing an average of 2.8% of the GB population (5 year peak mean 1998/9- 2002/3)
Greater white-fronted goose , <i>Anser albifrons albifrons</i> , NW Europe	2076 individuals, representing an average of 35.8% of the GB population (5 year peak mean for 1996/7-2000/01)
Common shelduck , <i>Tadorna tadorna</i> , NW Europe	3223 individuals, representing an average of 1% of the population (5 year peak mean 1998/9- 2002/3)
Gadwall , <i>Anas strepera strepera</i> , NW Europe	241 individuals, representing an average of 1.4% of the GB population (5 year peak mean 1998/9- 2002/3)
Dunlin , <i>Calidris alpina alpina</i> , W Siberia/W Europe	25082 individuals, representing an average of 1.8% of the population (5 year peak mean 1998/9-2002/3)
Common redshank , <i>Tringa totanus totanus</i> ,	2616 individuals, representing an average of 1% of the population (5 year peak mean 1998/9- 2002/3)

Species/populations identified subsequent to designation for possible future consideration under criterion 6.

Species regularly supported during the breeding season:

Lesser black-backed gull , <i>Larus fuscus graellsii</i> , W Europe/Mediterranean/W Africa	4167 apparently occupied nests, representing an average of 2.8% of the breeding population (Seabird 2000 Census)
---	--

Species with peak counts in spring/autumn:

Ringed plover , <i>Charadrius hiaticula</i> , Europe/Northwest Africa	740 individuals, representing an average of 1% of the population (5 year peak mean 1998/9- 2002/3)
--	--

Species with peak counts in winter:

Eurasian teal , <i>Anas crecca</i> , NW Europe	4456 individuals, representing an average of 1.1% of the population (5 year peak mean 1998/9-2002/3)
Northern pintail , <i>Anas acuta</i> , NW Europe	756 individuals, representing an average of 1.2% of the population (5 year peak mean 1998/9- 2002/3)

Contemporary data and information on waterbird trends at this site and their regional (sub-national) and national contexts can be found in the Wetland Bird Survey report, which is updated annually. See www.bto.org/survey/webs/webs-alerts-index.htm.

See Sections 21/22 for details of noteworthy species

Details of bird species occurring at levels of National importance are given in Section 22

15. Biogeography (required when Criteria 1 and/or 3 and /or certain applications of Criterion 2 are applied to the designation):

Name the relevant biogeographic region that includes the Ramsar site, and identify the biogeographic regionalisation system that has been applied.

a) biogeographic region:

Atlantic

b) biogeographic regionalisation scheme (include reference citation):

Council Directive 92/43/EEC

16. Physical features of the site:

Describe, as appropriate, the geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth, water permanence; fluctuations in water level; tidal variations; downstream area; general climate, etc.

Soil & geology	alluvium, basic, biogenic reef, clay, cobble, gravel, limestone/chalk, mud, neutral, nutrient-rich, peat, sand, sandstone/mudstone, sedimentary, shingle
Geomorphology and landscape	cliffs, coastal, estuary, floodplain, intertidal rock, intertidal sediments (including sandflat/mudflat), islands, lowland, open coast (including bay), pools, subtidal rock (including rocky reefs), subtidal sediments (including sandbank/mudbank), tidal rapids
Nutrient status	eutrophic
pH	circumneutral
Salinity	brackish / mixosaline, saline / euhaline
Soil	mainly mineral
Water permanence	usually permanent
Summary of main climatic features	Annual averages (Cardiff, 1971–2000) (www.metoffice.com/climate/uk/averages/19712000/sites/cardiff.html) Max. daily temperature: 14.3° C Min. daily temperature: 6.8° C Days of air frost: 33.0 Rainfall: 1111.7 mm Hrs. of sunshine: 1518.0

General description of the Physical Features:

The Severn Estuary is a large estuary with extensive intertidal mudflats and sandflats, rocky platforms and islands. Saltmarsh fringes the coast backed by grazing marsh with freshwater ditches and occasional brackish ditches. The seabed is rock and gravel with subtidal sandbanks. The estuary's classic funnel shape, unique in the UK, is a factor causing the Severn to have the second-highest tidal range in the world. This tidal regime results in plant and animal communities typical of the extreme physical conditions of liquid mud and tide-swept sand and rock. A further consequence of the large tidal range is an extensive intertidal zone, one of the largest in the UK.

17. Physical features of the catchment area:

Describe the surface area, general geology and geomorphological features, general soil types, general land use, and climate (including climate type).

The Severn Estuary is a large estuary with extensive intertidal mudflats and sandflats, rocky platforms and islands. Saltmarsh fringes the coast backed by grazing marsh with freshwater ditches and occasional brackish ditches. The seabed is rock and gravel with subtidal sandbanks. The estuary's classic funnel shape, unique in the UK, is a factor causing the Severn to have the second-highest tidal range in the world. This tidal regime results in plant and animal communities typical of the extreme physical conditions of liquid mud and tide-swept sand and rock. A further consequence of the large tidal range is an extensive intertidal zone, one of the largest in the UK.

18. Hydrological values:

Describe the functions and values of the wetland in groundwater recharge, flood control, sediment trapping, shoreline stabilization, etc.

Shoreline stabilisation and dissipation of erosive forces, Sediment trapping

19. Wetland types:

Inland wetland, Marine/coastal wetland

Code	Name	% Area
G	Tidal flats	84.1
H	Salt marshes	4.7
D	Rocky shores	4.7
E	Sand / shingle shores (including dune systems)	4.4
Tp	Freshwater marshes / pools: permanent	1
B	Marine beds (e.g. sea grass beds)	0.9
F	Estuarine waters	0.2

20. General ecological features:

Provide further description, as appropriate, of the main habitats, vegetation types, plant and animal communities present in the Ramsar site, and the ecosystem services of the site and the benefits derived from them.

The large tidal range leads to strong tidal streams and high turbidity, producing communities characteristic of the extreme physical conditions of liquid mud and tide-swept sand and rock. Broad intertidal flats with areas of unstable sand and muddy flats support high densities of invertebrates. Intertidal rock platforms support a wide variety of invertebrate species. There are large areas of subtidal sand, rock and gravel with a variety of aquatic estuarine communities including *Sabellaria alveolata* reef. Areas of saltmarsh fringe the estuary, mostly grazed with a range of vegetation communities. There are gradual and stepped transitions between bare mudflat to upper marsh and grassland. Main vegetation types are: upper saltmarsh with *Festuca rubra* and *Juncus gerardii*; middle marsh dominated by *Puccinellia maritima* with *Glaux maritima* and *Triglochin maritima*; dense monocultures of *Spartina anglica* at the edge of the mudflats-brackish pools and depressions with *Phragmites australis* and *Bolboschoenus maritimus*.

Ecosystem services

21. Noteworthy flora:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in 12. Justification for the application of the Criteria) indicating, e.g. which species/communities are unique, rare, endangered or biogeographically important, etc. Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.

Nationally important species occurring on the site.**Higher Plants.**

Aster linosyris (nationally rare),

Alopecurus bulbosus, *Althaea officinalis*, *Bupleurum tenuissimum*, *Hordeum marinum*, *Lepidium latifolium*, *Petroselinum segetum*, *Puccinellia rupestris*, *Trifolium squamosum*, *Zostera marina/angustifolia*, *Zostera noltei* (all nationally scarce)

22. Noteworthy fauna:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in 12. Justification for the application of the Criteria) indicating, e.g. which species/communities are unique, rare, endangered or biogeographically important, etc., including count data. Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.

Birds**Species currently occurring at levels of national importance:****Species regularly supported during the breeding season:**

Herring gull , *Larus argentatus argentatus*, NW 1540 apparently occupied nests, representing an average of 1.1% of the GB population (Seabird Europe and Iceland/W Europe) 2000 Census)

Species with peak counts in spring/autumn:

Little egret , <i>Egretta garzetta</i> , West Mediterranean	17 individuals, representing an average of 1% of the GB population (5 year peak mean 1998/9-2002/3)
Ruff , <i>Philomachus pugnax</i> , Europe/W Africa	12 individuals, representing an average of 1.7% of the GB population (5 year peak mean 1998/9-2002/3)
Whimbrel , <i>Numenius phaeopus</i> , Europe/Western Africa	333 individuals, representing an average of 11.1% of the GB population (5 year peak mean 1998/9-2002/3 - spring peak)
Eurasian curlew , <i>Numenius arquata arquata</i> , N. a. arquata Europe (breeding)	2021 individuals, representing an average of 1.3% of the GB population (5 year peak mean 1998/9-2002/3)
Common greenshank , <i>Tringa nebularia</i> , Europe/W Africa	26 individuals, representing an average of 4.3% of the GB population (5 year peak mean 1998/9-2002/3)
Species with peak counts in winter:	
Eurasian wigeon , <i>Anas penelope</i> , NW Europe	4658 individuals, representing an average of 1.1% of the GB population (5 year peak mean 1998/9-2002/3)
Northern shoveler , <i>Anas clypeata</i> , NW & C Europe	297 individuals, representing an average of 2% of the GB population (5 year peak mean 1998/9-2002/3)
Common pochard , <i>Aythya ferina</i> , NE & NW Europe	1118 individuals, representing an average of 1.8% of the GB population (5 year peak mean 1998/9-2002/3)
Water rail , <i>Rallus aquaticus</i> , Europe	11 individuals, representing an average of 2.4% of the GB population (5 year peak mean 1998/9-2002/3)
Spotted redshank , <i>Tringa erythropus</i> , Europe/W Africa	10 individuals, representing an average of 7.3% of the GB population (5 year peak mean 1998/9-2002/3)

Species Information

Species occurring at levels of international importance on the site.

Fish.

Alosa alosa (IUCN Red data book – threatened; Habitats Directive Annex II, Annex V (S1102)),
Alosa fallax (IUCN Red data book – threatened; Habitats Directive Annex II, Annex V (S1103))
Lampetra fluviatilis (IUCN Red data book – threatened; Habitats Directive Annex II (S1099)),
Petromyzon marinus (Habitats Directive Annex II (S1095))

Nationally important species occurring on the site.

Invertebrates.

Tenellia adspersa (nationally rare); *Corophium lacustre* (nationally scarce); *Gammarus insensibilis* (nationally scarce)

23. Social and cultural values:

Describe if the site has any general social and/or cultural values e.g. fisheries production, forestry, religious importance, archaeological sites, social relations with the wetland, etc. Distinguish between historical/archaeological/religious significance and current socio-economic values.

Aesthetic
 Archaeological/historical site
 Environmental education/ interpretation

Fisheries production
 Livestock grazing
 Non-consumptive recreation
 Scientific research
 Sport fishing
 Sport hunting
 Tourism
 Traditional cultural
 Transportation/navigation

b) Is the site considered of international importance for holding, in addition to relevant ecological values, examples of significant cultural values, whether material or non-material, linked to its origin, conservation and/or ecological functioning? **No**

If Yes, describe this importance under one or more of the following categories:

- i) sites which provide a model of wetland wise use, demonstrating the application of traditional knowledge and methods of management and use that maintain the ecological character of the wetland:
- ii) sites which have exceptional cultural traditions or records of former civilizations that have influenced the ecological character of the wetland:
- iii) sites where the ecological character of the wetland depends on the interaction with local communities or indigenous peoples:
- iv) sites where relevant non-material values such as sacred sites are present and their existence is strongly linked with the maintenance of the ecological character of the wetland:

24. Land tenure/ownership:

Ownership category	On-site	Off-site
Non-governmental organisation (NGO)	+	+
Local authority, municipality etc.	+	+
National/Crown Estate	+	
Private	+	+
Public/communal	+	+
Other	+	

25. Current land (including water) use:

Activity	On-site	Off-site
Nature conservation	+	+
Tourism	+	+
Recreation	+	+
Current scientific research	+	+
Fishing: commercial	+	+
Fishing: recreational/sport	+	+
Gathering of shellfish	+	
Bait collection	+	
Arable agriculture (unspecified)		+
Grazing (unspecified)	+	+
Permanent pastoral agriculture		+

Hunting: recreational/sport	+	+
Industrial water supply	+	
Industry	+	+
Sewage treatment/disposal	+	+
Harbour/port	+	+
Flood control	+	+
Mineral exploration (excl. hydrocarbons)	+	+
Mining/quarrying	+	+
Transport route	+	+
Urban development		+
Military activities	+	+

26. Factors (past, present or potential) adversely affecting the site's ecological character, including changes in land (including water) use and development projects:

Explanation of reporting category:

1. Those factors that are still operating, but it is unclear if they are under control, as there is a lag in showing the management or regulatory regime to be successful.
2. Those factors that are not currently being managed, or where the regulatory regime appears to have been ineffective so far.

NA = Not Applicable because no factors have been reported.

Adverse Factor Category	Reporting Category	Description of the problem (Newly reported Factors only)	On-Site	Off-Site	Major Impact?
Dredging	1		+	+	+
Erosion	1		+		+
Recreational/tourism disturbance (unspecified)	1		+	+	

For category 2 factors only.

What measures have been taken / are planned / regulatory processes invoked, to mitigate the effect of these factors?

Is the site subject to adverse ecological change? NO

27. Conservation measures taken:

List national category and legal status of protected areas, including boundary relationships with the Ramsar site; management practices; whether an officially approved management plan exists and whether it is being implemented.

Conservation measure	On-site	Off-site
Site/ Area of Special Scientific Interest (SSSI/ASSI)	+	+

National Nature Reserve (NNR)	+	
Special Protection Area (SPA)	+	
Land owned by a non-governmental organisation for nature conservation	+	+
Management agreement	+	+
Site management statement/plan implemented	+	
Other	+	
Management plan in preparation	+	+

b) Describe any other current management practices:

The management of Ramsar sites in the UK is determined by either a formal management plan or through other management planning processes, and is overseen by the relevant statutory conservation agency. Details of the precise management practises are given in these documents.

28. Conservation measures proposed but not yet implemented:

e.g. management plan in preparation; official proposal as a legally protected area, etc.

No information available

29. Current scientific research and facilities:

e.g. details of current research projects, including biodiversity monitoring; existence of a field research station, etc.

Contemporary.**Fauna.**

Numbers of migratory and wintering wildfowl and waders are monitored annually as part of the national Wetland Birds Survey (WeBS) organised by the British Trust for Ornithology, Wildfowl & Wetlands Trust, the Royal Society for the Protection of Birds and the Joint Nature Conservation Committee.

Wildfowl shooting monitoring. Returns received annually from Wildfowling Clubs.

Completed.**Flora and Fauna.**

CCW/EN Marine Intertidal Phase 1 survey of the biotopes of the Severn Estuary in 2003/4
BTO Research report 335 for CCW/EN (November 2003). Low tide distribution of waterbirds of Severn Estuary SPA. Results of 2002/03 WeBS low tide counts and a historical analysis (Burton *et al.* 2003).

WWT Wetlands Advisory Service. Report for CCW (April 2003). Baseline bird monitoring of the River Severn.

Joint Nature Conservation Committee (1997) Subtidal biotope survey at mouth of the River Parrett.

Joint Nature Conservation Committee (1997) Upper estuary intertidal rocky shore survey.

Mettam, C (1997) *Biotopes in the subtidal sandbanks of the Severn estuary*. Report to English Nature

30. Current communications, education and public awareness (CEPA) activities related to or benefiting the site:

e.g. visitor centre, observation hides and nature trails, information booklets, facilities for school visits, etc.

There are fixed interpretation panels and hides at Bridgwater Bay, Newport Wetlands Reserve, Flat Holm LNR and field centre. Interpretation boards at Black Rock.

31. Current recreation and tourism:

State if the wetland is used for recreation/tourism; indicate type(s) and their frequency/intensity.

Activities, Facilities provided and Seasonality.

Walking, dog walking, and birdwatching are concentrated along the sea walls all the year round and on the saltmarsh and sandy beaches.

Bathing, beach recreation, including sand yachting and wind surfing are practised on the sandy beaches, mainly in the summer.

There are boat clubs/marinas in the sub-estuaries with sailing, motor boats, and jet skiing. Angling is carried out from the shore and small boats. There is a certain amount of bait digging. Wildfowling is carried out from September to February all around the Estuary; consents and further management measures are being addressed. There are agreed refuge areas for the birds.

32. Jurisdiction:

Include territorial, e.g. state/region, and functional/sectoral, e.g. Dept. of Agriculture/Dept. of Environment, etc.

Head, Natura 2000 and Ramsar Team, Department for Environment, Food and Rural Affairs,
European Wildlife Division, Zone 1/07, Temple Quay House, 2 The Square, Temple Quay, Bristol,
BS1 6EB

Head, Countryside Division, Welsh Assembly Government, Cathays Park, Cardiff, CF1 3NQ

33. Management authority:

Provide the name and address of the local office(s) of the agency(ies) or organisation(s) directly responsible for managing the wetland. Wherever possible provide also the title and/or name of the person or persons in this office with responsibility for the wetland.

Site Designations Manager, English Nature, Sites and Surveillance Team, Northminster House,
Northminster Road, Peterborough, PE1 1UA, UK / Site Safeguard Officer, International
Designations, Countryside Council for Wales, Maes-y-Ffynnon, Penrhosgarnedd, Bangor,
Gwynedd, LL57 2DW

34. Bibliographical references:

Scientific/technical references only. If biogeographic regionalisation scheme applied (see 15 above), list full reference citation for the scheme.

Site-relevant references

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**CYNGOR CEFN GWLAD CYMRU
COUNTRYSIDE COUNCIL FOR WALES**

**CORE MANAGEMENT PLAN
(INCLUDING CONSERVATION OBJECTIVES)**

FOR

Cardiff Beech Woods Special Area of Conservation (SAC)

**(underpinned by Garth Woods SSSI, Castell Coch Woodlands and Road Section SSSI,
and Fforestganol a Chwm Nofydd SSSI)**

Date: 12 December 2008 (Minor map edit, August 2012)

Approved by: David Mitchell

A Welsh version of all or part of this document can be made available on request.



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PREFACE

This document provides the main elements of CCW's management plan for the site named. It sets out what needs to be achieved on the site, the results of monitoring and advice on the action required. This document is made available through CCW's web site and may be revised in response to changing circumstances or new information. This is a technical document that supplements summary information on the web site.

One of the key functions of this document is to provide CCW's statement of the Conservation Objectives for the relevant Natura 2000 site. This is required to implement the Conservation (Natural Habitats, &c.) Regulations 1994, as amended (Section 4). As a matter of Welsh Assembly Government Policy, the provisions of those regulations are also to be applied to Ramsar sites in Wales.

1. **VISION FOR THE SITE**

This is a descriptive overview of what needs to be achieved for conservation on the site. It brings together and summarises the Conservation Objectives (part 4) into a single, integrated statement about the site.

The woodland is dominated by beech trees with their bright green leaves forming what appears to be a dense canopy overhead. Natural woodland processes however ensure a dynamic shifting pattern of canopy gaps. Viable saplings emerge from the understorey, not just locally native beech but also ash and oak. Sycamore is a small component, accepted here as a natural part of the system. The distinctive bark of hornbeam can also be seen. Areas of steep or rocky ground support ash, wych elm and lime trees. Trees of different ages are present; wizened veterans contrasting with fresh young growth.

Away from the network of public footpaths and bridleways, large trees are present with potential to fall and create gaps in the canopy. Areas of advanced regeneration are maintained; saplings waiting their turn for a canopy gap and opportunity to flourish. Both standing and fallen dead wood abound with invertebrate life and fungi.

In spring, the garlicky smell of ramsons and the blue haze of bluebells draw attention to the ground layers which also yield sanicle, birds nest orchids, dogs mercury and ferns. These plants remind us that the woodlands are centuries old and the soils are lime-rich.

Cultural heritage interest and recreational use is promoted alongside the nature conservation interest of the site. A safe environment is maintained for public access through the woodland. Recreational use is restricted to the extensive network of pathways and access routes leaving natural woodland processes unhindered away from areas of public use. The balance of interests is maintained for all to enjoy - now and in the future.

2. SITE DESCRIPTION

2.1 Area and Designations Covered by this Plan

Grid reference: ST 118824 (approximate central point of the SAC)

Unitary authorities: Caerdydd/ Cardiff; Rhondda, Cynon, Taf/ Rhondda, Cynon, Taff

Area (hectares): 115.62

Designations covered:

The Cardiff Beech Woods Special Area of Conservation (SAC) is underpinned by three component Sites of Special Scientific Interest (SSSIs):

- **Garth Wood SSSI** (grid reference ST 125825). This was re-notified in 2001 to make the SSSI boundary identical to that of the SAC where they overlap. The SAC habitats occupy 67.9% of the SSSI. The rest of the SSSI supports semi natural broad-leaved woodland that does not meet SAC criteria. In addition, the SSSI supports a population of *Porrhoma rosenhaueri* (a cave dwelling spider) found within Lesser Garth Cave.
- **Fforestganol a Chwm Nofydd SSSI** (grid reference ST 147835). This was re-notified in 2001 to make the SSSI boundary identical to that of the SAC where the two overlap and to amalgamate the two SSSIs of Fforestganol, Tongwynlais and Cwm Nofydd. The SAC habitats occupy 12.9% of the SSSI. The rest of the SSSI supports semi natural broad-leaved woodland that does not meet SAC criteria. The site also includes Fforest Ganol and Cwm Nofydd Local Nature Reserve.
- **Castell Coch Woodlands and Road Section SSSI** (grid reference ST 131827). This was notified in 1990. The SAC habitats occupy 71% of the SSSI. The rest is made up of the geological interest of the Road Section.

Detailed maps of the designated sites are available through CCW's web site:
<http://www.ccw.gov.uk/interactive-maps/protected-areas-map.aspx>

A summary map showing the coverage of this document is shown in Annex A.

2.2 Outline Description

Cardiff Beech Woods SAC represents an area of semi-natural broadleaved woodland dominated by beech. There are two European features of interest present, ***Asperulo-fagetum* beech forest** and ***Tilio-acerion* forest of slopes, screes and ravines**. Both of these features are present within Garth Wood and Fforestganol a Chwm Nofydd SSSI but only the *Asperulo-fagetum* is found within Castell Coch Woodlands and Road Section SSSI.

Cardiff Beech Woods is considered to be one of the best areas in the United Kingdom for ***Asperulo-fagetum* beech forest**. The site contains one of the largest concentrations of *Asperulo-fagetum* beech forest in Wales, and represents the habitat close to the western limit of its range in both the UK and Europe. The woods show mosaics and transitions to other types, including more acidic beech woodland and oak *Quercus* and ash *Fraxinus excelsior* woodland. Characteristic and notable species in the ground flora include ramsons *Allium ursinum*, sanicle *Sanicula europea*, bird's-nest orchid *Neottia nidus-avis* and yellow bird's – nest orchid *Monotropa hypopitis*.

This habitat type occurs on circumneutral to calcareous soils. In the UK it mostly corresponds to NVC type W12 *Fagus sylvatica* – *Mercurialis perennis* woodland, but more calcareous stands of NVC type W14 *Fagus sylvatica* – *Rubus fruticosus* woodland may also conform to this habitat type. The two NVC types often occur together on a site.

The area is considered to support a significant presence of **Tilio-acerion forests of slopes, screes and ravines**. These woods consist of ash *Fraxinus excelsior*, wych elm *Ulmus glabra* and lime (mainly small-leaved lime *Tilia cordata* but more rarely large-leaved lime *T. platyphyllos*). Introduced sycamore *Acer pseudoplatanus* is often present.

The habitat type is found on calcareous substrates. The main NVC types conforming to *Tilio-acerion* forests are the ‘western’ forms (sub-communities d-g) of W8 *Fraxinus excelsior* – *Acer campestre*-*Mercurialis perennis* woodland, and the equivalent north-western community W9 *Fraxinus excelsior* – *Sorbus aucuparia* – *Mercurialis perennis* woodland.

Semi-natural broadleaved woodland is a feature of all three component SSSIs. In addition, Garth Wood SSSI supports a nationally rare cave dwelling spider *Porrhoma rosenhaueri*, and Castell Coch Woodlands and Road Section SSSI supports geological exposures.

The geological exposures present at Castell Coch Road Section show a sequence of rocks that includes the Devonian Old Red Sandstone and the younger Carboniferous Limestone. This site illustrates the boundary and environmental changes between the Devonian and Carboniferous periods. The Devonian rocks here come from a river delta environment, while the Carboniferous rocks were formed in shallow seas. The Carboniferous Limestone also includes a number of fossil-rich layers, including the remains of coral-like creatures (bryozoa and crinoids) and hinged shells (brachiopods).

2.3 Outline of Past and Current Management

General

There is a history of timber exploitation in some areas. Fellings in the 20th century have resulted in some areas of even-aged woodland structure with no successful natural regeneration.

Where there has been much disturbance from the history of quarrying and iron working, natural colonisation has been encouraged. However, some active woodland management is required to address health and safety issues arising from these areas.

The presence of a number of species considered to be non-native e.g. sycamore and Japanese knotweed, is currently under review to determine any detrimental effects on the woodland communities of special interest.

Cardiff County Council, Cadw and Forestry Commission carry out woodland management for conservation purposes and occasionally health and safety purposes.

For further details of current management issues, please see sections 5 and 6 of this report.

Garth Wood

Much of the woodland appears to have been managed in the past as high forest and includes areas that have been planted with beech and Corsican pine. Past and current quarrying in this area has caused disturbance and natural colonisation of these areas continues to be encouraged.

Castell Coch Woodlands

The last major management of the Castell Coch woodland took place over 50 years ago when the last thinning occurred. The only subsequent canopy gaps have appeared as a result of tree falls. For health and safety of the public who visit this site, dangerous trees adjacent to access routes are felled. There has also been sporadic removal of sycamore. All safely fallen trees have been left where they fell and dead wood has increased the biological diversity of the woodland. In addition, natural regeneration is occurring throughout the woodland, both underneath the canopy and within the gaps.

CCW is working with the Forestry Commission, Cadw and Cardiff County Council in allowing the natural woodland processes to continue, allowing wildlife to flourish on the site. This is reflected through an overall management policy of minimal intervention.

Fforestganol a Chwm Nofydd

The woodland has been managed for some time for nature conservation. Selective thinning, removal of sycamore and ride creation have occurred in the past. However, the long term aim has been to apply minimal management to the woodland and allow gap creation and regeneration processes to occur naturally.

There are areas of semi-natural woodland and plantation where all the trees are of similar age and there is little regeneration. These areas would benefit from some selective thinning, to stimulate the process of natural regeneration of tree species.

Current management of other habitat areas within the SSSI include grazing and scrub control to maintain their extent and distribution.

Fforestganol a Chwm Nofydd and Castell Coch Woodlands and Road Section experience heavy recreational pressure and are actively managed by Cardiff County Council and Cadw respectively for this purpose.

2.4 Management Units

The plan area has been divided into management units to enable practical communication about features, objectives, and management. This will also allow us to differentiate between the different designations where necessary. In this plan the management units have been based mainly on tenure, but also with reference to features and land management requirements.

A map showing the management units referred to in this plan is shown in Annex B.

The following table confirms the relationships between the management units and the designations covered:

Unit number	SAC	SSSI	CCW owned	LNR
Garth Wood SSSI				
GW 1	✓	✓	x	
GW 2	x	✓	x	
GW 3	x	✓	x	
Castell Coch Woodlands & Road Section SSSI				
CC 1	x	✓	x	
CC 2	x	✓	x	
CC 3	✓	✓	x	
CC 4	✓	✓	x	

Unit number	SAC	SSSI	CCW owned	LNR
Fforestganol & Cwm Nofydd SSSI				
FCN 1	✓	✓	x	
FCN 2	✓	✓	x	✓
FCN 3	✓	✓	x	
FCN 4	✓	✓	x	✓
FCN 5	x	✓	x	✓

3. THE SPECIAL FEATURES

3.1 Confirmation of Special Features

<i>Designated feature</i>	<i>Relationships, nomenclature etc</i>	<i>Conservation Objective in parts 4 and 5</i>
<i>SAC features</i>		
<i>Annex I habitats that are a primary reason for selection of this site</i> 1. <i>Asperulo-fagetum</i> beech forest (EU Habitat Code 9130)	Generally referred to as ' <i>Asperulo-fagetum</i> ' throughout this document.	4.1
<i>Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site</i> 2. <i>Tilio-acerion</i> forest of slopes, screes and ravines (EU Habitat Code 9180)	Generally referred to as ' <i>Tilio-acerion</i> ' throughout this document.	4.2
<i>SPA features</i>		
Not applicable		
<i>Ramsar features</i>		
Not applicable		
<i>SSSI features</i>		
3. Semi-natural broadleaved woodland		5.1
4. <i>Porrhoma rosenhaueri</i> (cave dwelling spider)		5.2
5. Geological exposures		5.3

3.2 Special Features and Management Units

This section sets out the relationship between the special features and each management unit. This is intended to provide a clear statement about what each unit should be managed for, taking into account the varied needs of the different special features. All special features are allocated to one of seven classes in each management unit. These classes are:

Key Features

KH - a 'Key Habitat' in the management unit, i.e. the habitat that is the main focus of management and monitoring effort, perhaps because of the dependence of a key species (see KS below). There will rarely be more than one Key Habitat in a unit.

KS – a 'Key Species' in the management unit, often driving both the selection and management of a Key Habitat.

Geo – an earth science feature that is the main focus of management and monitoring effort in a unit.

Other Features

Sym - habitats, species and earth science features that are of importance in a unit but are not the main focus of management or monitoring. These features will benefit from management for the key feature(s) identified in the unit. These may be classed as 'Sym' features because:

- they are present in the unit but are of less conservation importance than the key feature; and/or
- they are present in the unit but in small areas/numbers, with the bulk of the feature in other units of the site; and/or

c) their requirements are broader than and compatible with the management needs of the key feature(s).

Nm - an infrequently used category where features are at risk of decline within a unit as a result of meeting the management needs of the key feature(s), i.e. under Negative Management. These cases will usually be compensated for by management elsewhere in the plan, and can be used where minor occurrences of a feature would otherwise lead to apparent conflict with another key feature in a unit.

Mn - Management units with no special feature present but which are of importance for management of features elsewhere on a site e.g. livestock over-wintering area included within designation boundaries.

x – Features not present in the management unit.

The tables below sets out the relationship between the special features and management units identified in this plan:

Garth Wood	Management Unit		
	GW 1	GW 2	GW 3
SAC	✓	x	x
SSSI	✓	✓	✓
SAC features			
<i>Asperulo-fagetum</i> beech forest	KH	x	x
<i>Tilio-acerion</i> forest	KH	x	x
SSSI features			
Semi-natural broadleaved woodland	Sym	KH	KH
<i>Porrhoma rosenhaurei</i>	KS	Sym	x

Castell Coch Woodlands & Road Section	Management Unit			
	CC 1	CC 2	CC 3	CC 4
SAC	x	x	✓	✓
SSSI	✓	✓	✓	✓
SAC features				
<i>Asperulo-fagetum</i> beech forest	x	x	KH	KH
<i>Tilio-acerion</i> forest	x	x	x	x
SSSI features				
Semi-natural broadleaved woodland	NM	NM	Sym	Sym
Geological	Geo	Geo	x	x

Fforestganol & Cwm Nofydd	Management Unit				
	FCN 1	FCN 2	FCN 3	FCN 4	FCN 5
SAC	✓	✓	✓	✓	x
SSSI	✓	✓	✓	✓	✓
SAC features					
<i>Asperulo-fagetum</i> beech forest	x	KH	KH	KH	x
<i>Tilio-acerion</i> forest	KH	x	KH	KH	x
SSSI features					
Semi-natural broadleaved woodland	Sym	Sym	Sym	Sym	KH

The above management units reflect the presence of *Asperulo-fagetum* beech forest and *Tilio-acerion* forest of slopes, screes and ravines. Both of these features are present within Garth Wood SSSI and Fforestganol a Chwm Nofydd SSSI but only *Asperulo-fagetum* is found within Castell Coch Woodlands and Road Section SSSI. The semi-natural broadleaved

woodland feature of the SSSIs will benefit from sympathetic habitat management in these units.

The presence of the cave dwelling spider *Porrhoma rosenhaurei* as a feature of Garth Wood SSSI is considered compatible with the management needs of the woodland habitat in these units.

A small part of the semi-natural broadleaved woodland feature is present in units 1 and 2 of the Castell Coch Woodlands and Road Section SSSI and is considered potentially at risk of decline within these units as a result of meeting the management needs of the geological feature. However, this is considered to be compensated for by management elsewhere.

4. CONSERVATION OBJECTIVES

Background to Conservation Objectives:

a. Outline of the legal context and purpose of conservation objectives.

Conservation objectives are required by the 1992 'Habitats' Directive (92/43/EEC). The aim of the Habitats Directives is the maintenance, or where appropriate the restoration of the 'favourable conservation status' of habitats and species features for which SACs and SPAs are designated (see Box 1).

In the broadest terms, 'favourable conservation status' means a feature is in satisfactory condition and all the things needed to keep it that way are in place for the foreseeable future. CCW considers that the concept of favourable conservation status provides a practical and legally robust basis for conservation objectives for Natura 2000 and Ramsar sites.

Box 1

Favourable conservation as defined in Articles 1(e) and 1(i) of the Habitats Directive

“The conservation status of a natural habitat is the sum of the influences acting on it and its typical species that may affect its long-term natural distribution, structure and functions as well as the long term survival of its typical species. The conservation status of a natural habitat will be taken as favourable when:

- Its natural range and areas it covers within that range are stable or increasing, and
- The specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and
- The conservation status of its typical species is favourable.

The conservation status of a species is the sum of the influences acting on the species that may affect the long-term distribution and abundance of its populations. The conservation status will be taken as 'favourable' when:

- population dynamics data on the species indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and
- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and
- There is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.”

Achieving these objectives requires appropriate management and the control of factors that may cause deterioration of habitats or significant disturbance to species.

As well as the overall function of communication, Conservation objectives have a number of specific roles:

- Conservation planning and management.

The conservation objectives guide management of sites, to maintain or restore the habitats and species in favourable condition.

- Assessing plans and projects.

Article 6(3) of the ‘Habitats’ Directive requires appropriate assessment of proposed plans and projects against a site's conservation objectives. Subject to certain exceptions, plans or projects may not proceed unless it is established that they will not adversely affect the integrity of sites. This role for testing plans and projects also applies to the review of existing decisions and consents.

- Monitoring and reporting.

The conservation objectives provide the basis for assessing the condition of a feature and the status of factors that affect it. CCW uses ‘performance indicators’ within the conservation objectives, as the basis for monitoring and reporting. Performance indicators are selected to provide useful information about the condition of a feature and the factors that affect it.

The conservation objectives in this document reflect CCW’s current information and understanding of the site and its features and their importance in an international context. The conservation objectives are subject to review by CCW in light of new knowledge.

b. Format of the conservation objectives

There is one conservation objective for each feature listed in part 3. Each conservation objective is a composite statement representing a site-specific description of what is considered to be the favourable conservation status of the feature. These statements apply to a whole feature as it occurs within the whole plan area, although section 3.2 sets out their relevance to individual management units.

Each conservation objective consists of the following two elements:

1. Vision for the feature
2. Performance indicators

As a result of the general practice developed and agreed within the UK Conservation Agencies, conservation objectives include performance indicators, the selection of which should be informed by JNCC guidance on Common Standards Monitoring¹.

There is a critical need for clarity over the role of performance indicators within the conservation objectives. **A conservation objective, because it includes the vision for the feature, has meaning and substance independently of the performance indicators, and is more than the sum of the performance indicators.** The performance indicators are simply what make the conservation objectives measurable, and are thus part of, not a substitute for, the conservation objectives. Any feature attribute identified in the performance indicators should be represented in the vision for the feature, but not all elements of the vision for the feature will necessarily have corresponding performance indicators.

As well as describing the aspirations for the condition of the feature, the Vision section of each conservation objective contains a statement that the factors necessary to maintain those desired conditions are under control. Subject to technical, practical and resource constraints, factors which have an important influence on the condition of the feature are identified in the performance indicators.

¹ Available through www.jncc.gov.uk and follow links to Protected Sites and Common Standards Monitoring.

4.1 Conservation Objective for Feature 1: *Asperulo-Fagetum* beech forest (EU Habitat Code 9130)

Vision for feature 1

The vision for this feature is for it to be in a favourable conservation status, where all of the following conditions are satisfied:

- The existing *Asperulo-fagetum* beech forest will be maintained.
- At least 95% of canopy forming trees will be locally native species such as beech, ash and oak, with some areas dominated by beech.
- The tree canopy will not be completely closed; approximately 10% of the canopy will include a dynamic shifting pattern of gaps encouraging natural regeneration of tree species of all ages.
- Dead wood, standing and fallen, will be maintained where possible to provide habitat for invertebrates, fungi and other woodland species.
- There are pockets of ground flora across the site, comprising species typical of lime-rich beech wood, including indicators of ancient woodland such as wood anemone, ramsons and sanicle.
- There is little evidence of browsing or squirrel damage to trees.
- Recreational use of the site will continue to be managed so it does not damage the wildlife interest of the site.
- All factors affecting the achievement of these conditions are under control.

Performance indicators for feature 1

The performance indicators are part of the conservation objective, not a substitute for it. Assessment of plans and projects must be based on the entire conservation objective, not just the performance indicators.

Performance indicators for feature condition		
Attribute	Attribute rationale and other comments	Specified limits
A1. Extent	For a habitat feature to be considered to be at favourable conservation status, the area of the habitat must be stable in the long-term or increasing. Upper limit – restricted by the limits set in the conservation objective for the <i>Tilio-acerion</i> feature. Lower limit - based on current extent.	<i>Upper limit:</i> None set <i>Lower limit:</i> As mapped (Garth Wood and Fforestganol a Chwm Nofydd in 1997 and Castell Coch Woodlands and Road Section in 1990)
A2. Quality	For a habitat feature to be considered to be at favourable conservation status, its quality (including in terms of ecological structure and function) must be maintained. <u>Good condition <i>Asperulo-fagetum</i> woodland of Garth Wood definition:</u> Within a 25m radius of a sample point* all of the following criteria must be met:	<i>Upper limit:</i> Not required <i>Lower limit:</i> The following are met: In Unit 1 of Garth Wood, 70% of the woodland habitat is referable to ‘good condition <i>Asperulo-fagetum</i> woodland of Garth Wood’ and there are at least 4 patches of advanced beech regeneration.

	- o At least 95% of the canopy forming trees are native to the site with at least 50% of the canopy forming trees being <i>Fagus sylvatica</i> AND - o There are at least 5 mature trees present AND - o There are at least 5 sapling present AND - o There are at least 3 relevant ground flora species present and there is no evidence of grazing AND - o Dead wood is present in at least 2 forms <u>Good condition <i>Asperulo-fagetum</i> woodland of Castell Coch definition:</u> As above except the definition requires the criteria to be met in a 12.5m radius of a sample point* (NOT 25m radius) and only requires 3 mature trees to be present <u><i>Asperulo-fagetum</i> forest definition:</u> The canopy is generally dominated by <i>Fagus sylvestris</i> however in some areas <i>Fraxinus excelsior</i> shares dominance. The shrub layer is sparse with scattered <i>Corylus avellana</i> and <i>Fagus</i> saplings and occasional <i>Ilex aquifolium</i>. The field layer is also characterised by its sparseness, largely due to the presence of deep leaf litter, low light levels and thin soils. Patches of bare ground are frequent. However in some areas <i>Rubus fruticosus</i> or <i>Hedera helix</i> can form dense patches. Other associated ground flora species include <i>Mercurialis perennis</i>, <i>Hyacinthoides non-scripta</i> and <i>Luzula sylvatica</i> and <i>Dryopteris filis-mas</i>	In Units 3 and 4 of Castell Coch Woodlands, 60% of the woodland habitat is referable to ‘good condition <i>Asperulo-fagetum</i> woodland of Castell Coch’ and there are at least 4 patches of advanced beech regeneration. In Unit 1 of Fforestganol a Chwm Nofydd, <i>Fagus sylvatica</i> is present within a 25m radius of a sample point*. In Units 2 and 3 of Fforestganol a Chwm Nofydd, habitat present within a 25m radius of a sample point* meets the definition of ‘<i>Asperulo-fagetum</i> forest’.
A3. Canopy cover	Woodland structure to include a shifting dynamic of canopy gaps to encourage natural regeneration	<i>Upper limit:</i> No more than 85% canopy cover <i>Lower limit:</i> As existing
A4. Viable saplings	Native species sapling of > 1.5m	<i>Upper limit:</i> Not required <i>Lower limit:</i> 5 no. of successive cohorts in 25m x 25m sample plot* of understorey
A5. Advanced regeneration	Areas of regeneration >10m x 10m with 50+ beech saplings/seedlings. Each area	<i>Upper limit:</i> Not required

	of advance regeneration needs to be separated by a minimum of 10m	<i>Lower limit:</i> 4 areas of regeneration in each of Garth Wood, Castell Coch Woodlands and Fforestganol a Chwm Nofydd noted every 6 years
A6. Species composition	Any species native to the area, including <i>Acer pseudoplatanus</i>	<i>Upper limit:</i> At least 95% of the canopy forming trees are native to the site with at least 50% of the canopy forming trees being <i>Fagus sylvatica</i> <i>Lower limit:</i> As existing
A7. Age structure	All age classes represented including mature and veteran trees. Mature tree: canopy forming tree with a girth of >150cm at chest height	<i>Upper limit:</i> None set <i>Lower limit:</i> At least 5 mature trees present within a 25m radius of a sample point*
A8. Ground flora species	Three of the following: <i>Mercurialis perennis</i> , <i>Hyacinthoides non-scripta</i> , <i>Hedera helix</i> , <i>Allium ursinum</i> , <i>Anemone nemorosa</i> , <i>Circaea lutetiana</i> , <i>Arum maculatum</i> , <i>Sanicula europaea</i> , <i>Geum urbanum</i> or <i>Melica uniflora</i>	<i>Upper limit:</i> Not required <i>Lower limit:</i> At least 3 ground flora species present within a 25m radius of a sample point* and no evidence of browsing
A9. Dead wood	Fallen trees, fallen branches, dead branches on living trees or standing dead trees (all > 20cm in diameter) All dead wood (standing or fallen) left in situ	<i>Upper limit:</i> None set <i>Lower limit:</i> Dead wood present in at least 2 forms within a 25m radius of a sample point*
A10. Evidence of browsing	Signs of browsing particularly on saplings (where tops have been taken off) or ferns (where fronds/pinnae have been removed)	No limits set
A11. Evidence of bark stripping by squirrels	Signs of bark stripping by squirrels	No limits set
* Sampling points as defined in Wilkinson, K. (17 March 2004) Cardiff Beech Woods cSAC, Annex 1 Habitat (9130) <i>Asperulo-Fagetum</i> beech forests SAC Monitoring Report (draft)		
Performance indicators for factors affecting the feature		
Factor	Factor rationale and other comments	Operational Limits
F1. Recreational Use	The woodlands, especially Castell Coch and Fforestganol a Chwm Nofydd, experience heavy recreational pressure and certain areas are managed for this purpose. Health and safety considerations (discussed below) are relevant here.	No limits set. Pending a fuller understanding of current situation and impact on habitat. Access issues need to be kept under review.
F2. Health & safety	In addition to general health and safety issues arising from woodland	No limits set.

	management for conservation purposes, site-specific safety issues need to be addressed by management. Such issues may arise from the presence of old quarry workings, and ‘unsafe’ trees in vicinity of public footpaths, access routes and car parks etc.	
F3. Atmospheric pollution	The location of the woodland in industrialised South Wales, together with the presence of nearby quarrying and associated activities, means that there is the potential for localised atmospheric pollution.	No limits set. There is no evidence to date that this has had an adverse impact on the features but this may need to be addressed in more detail in the future.
F4. Development	Its location in the populated South Wales area means that there is considerable development pressure in the vicinity including associated infrastructure on land adjacent to the site. There is the potential for a range of impacts arising from increasing urbanisation.	No limits set. May need to be considered in the future.
F5. Commercial forestry	Commercial forestry in the vicinity of Castell Coch may have implications for surface water supply and quality, and this needs to be kept under review.	No limits set. Pending a fuller understanding of current situation and impact on habitat.
F6. Mineral extraction	There are a number of active and disused limestone quarries in the area. Garth Wood surrounds Taff’s Well Quarry but there are other, smaller quarries in and around all component SSSIs. Quarrying can lead to direct loss of the feature together with indirect impacts from issues such as access. There are also a number of impacts arising from restoration at the end of a quarry’s working life. (For aerial impacts see atmospheric pollution above.)	No limits set. Pending a fuller understanding of current situation and impact on habitat. Quarry restoration may need to be considered in the future.
F7. Cultural heritage	There is considerable cultural heritage interest in the area, including Castell Coch and industrial workings. The associated health and safety issues are addressed above. The management of these sites needs to be balanced with the requirements of the conservation objectives.	No limits set.

4.2 Conservation Objective for Feature 2:

Tilio-Acerion forest of slopes, screes and ravines (EU Habitat Code 9180)

Vision for feature 2

The vision for this feature is for it to be in a favourable conservation status, where all of the following conditions are satisfied:

- The existing *Tilio-acerion* forest will be maintained.
- At least 95% of canopy forming trees will be locally native species (sycamore included).
- The tree canopy will not be completely closed; approximately 10% of the canopy will include a dynamic shifting pattern of gaps encouraging natural regeneration of tree species of all ages.
- Dead wood, standing and fallen, will be maintained where possible to provide habitat for invertebrates, fungi and other woodland species.
- There are pockets of ground flora across the site, comprising species typical of lime-rich beech wood, including indicators of ancient woodland such as wood anemone, ramsons and sanicle.
- There is little evidence of browsing or squirrel damage to trees.
- Recreational use of the site will continue to be managed so it does not damage the wildlife interest of the site.
- All factors affecting the achievement of these conditions are under control.

Performance indicators for feature 2

The performance indicators are part of the conservation objective, not a substitute for it. Assessment of plans and projects must be based on the entire conservation objective, not just the performance indicators.

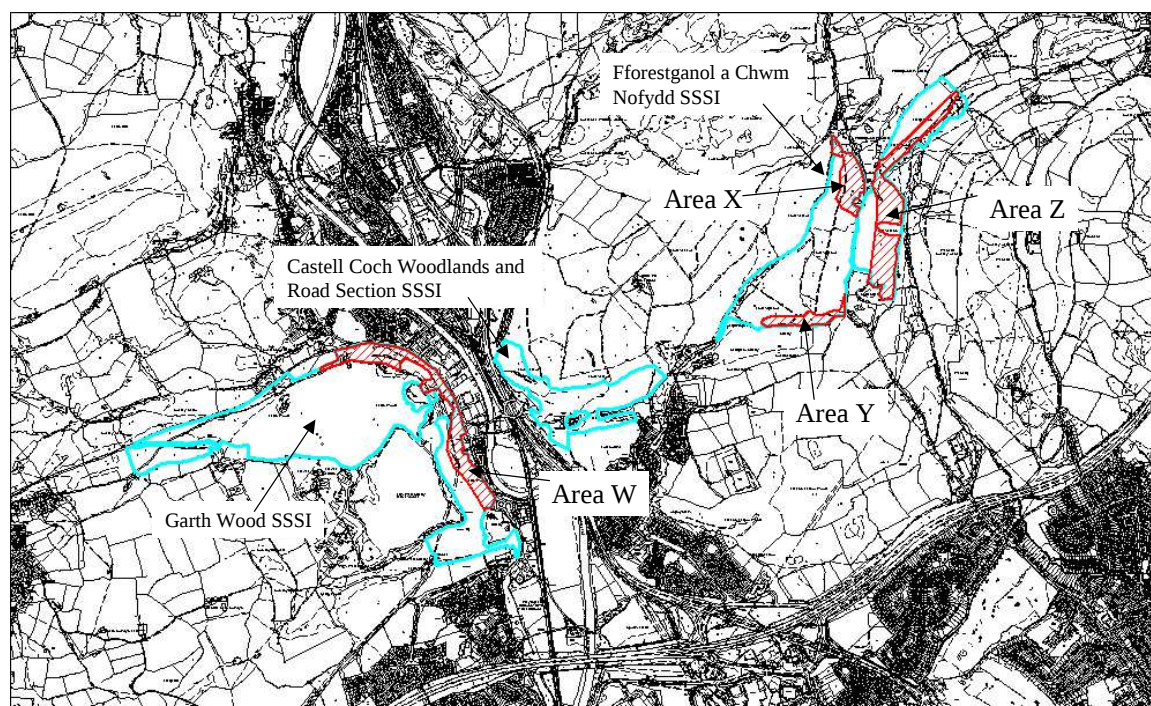
Performance indicators for feature condition		
Attribute	Attribute rationale and other comments	Specified limits
A1. Extent	For a habitat feature to be considered to be at favourable conservation status, the area of the habitat must be stable in the long-term or increasing. Upper Limit – restricted by the limits set in the conservation objective for the <i>Asperulo-fagetum</i> feature. Lower limit - based on current extent. <u><i>Tilio-acerion</i> forest definition:</u> Woodland on steep, rocky limestone slopes or sloping, ‘undulating’ ground. <i>Fraxinus excelsior</i> is at least present in the canopy and is generally associated with a wide variety of other canopy forming species e.g. <i>Fagus sylvatica</i> and <i>Acer pseudoplatanus</i>. <i>Phyllitis scolopendrium</i> is at least present in the ground flora within a 10m radius of a sample point*. In addition <i>Dryopteris</i> species are often present.	<i>Upper limit:</i> None set <i>Lower limit:</i> <i>Tilio-acerion</i> is present in at least four locations in Unit 1 of Garth Wood, two locations in Unit 1 of Fforestganol a Chym Nofydd, and as mapped in Units 3 and 4 of Fforestganol a Chym Nofydd (see Map 1 below)

A2. Quality	For a habitat feature to be considered to be at favourable conservation status, its quality (including in terms of ecological structure and function) must be maintained. <u>‘Good condition’ semi-natural broadleaf woodland definition:</u> Woodland where within a 25m radius of a sample point* all of the following are met: - o At least 95% of the canopy forming trees are native to the site AND - o At least 5 mature trees are present AND - o There are 5 viable saplings present AND - o There are at least 3 relevant ground flora species present and there is no evidence of browsing AND - o Dead wood is present in at least two forms AND - o There are no tracks present other than those highlighted on Map 2 below	<i>Upper limit:</i> Not required <i>Lower limit:</i> The following are met: In Units 3 and 4 of Fforestganol a Chym Nofydd (Area Z of Map 1 below) the <i>Tilio-acerion</i> is referable to ‘good condition’ semi-natural broadleaf woodland.
A3. Canopy Cover	Woodland structure to include a shifting dynamic of canopy gaps to encourage natural regeneration	<i>Upper limit:</i> No more than 85% canopy cover <i>Lower limit:</i> As existing
A4. Viable saplings	Native species sapling of > 1.5m	<i>Upper limit:</i> Not required <i>Lower limit:</i> 5 no. of successive cohorts in 25m x 25m sample plot* of understorey
A5. Species composition	Any species native to the area, including <i>Acer pseudoplatanus</i>	<i>Upper limit:</i> At least 95% of the canopy forming trees are native to the site <i>Lower limit:</i> As existing
A6. Age structure	All age classes represented including mature and veteran trees. Mature tree: canopy forming tree with a girth of >150cm at chest height	<i>Upper limit:</i> None set <i>Lower limit:</i> At least 5 mature trees present within a 25m radius of a sample point*
A7. Ground flora species	Three of the following: <i>Mercurialis perennis</i> , <i>Hyacinthoides non-scripta</i> , <i>Hedera helix</i> , <i>Allium ursinum</i> , <i>Anemone nemorosa</i> , <i>Circaea lutetiana</i> , <i>Arum maculatum</i> , <i>Sanicula europaea</i> , <i>Geum</i>	<i>Upper limit:</i> Not required <i>Lower limit:</i> At least 3 ground flora species present within a 25 m radius of a sample point* and no evidence

	<i>urbanum</i> or <i>Melica uniflora</i>	of browsing
A8. Dead wood	Fallen trees, fallen branches, dead branches on living trees or standing dead trees (all > 20cm in diameter) All dead wood (standing or fallen) left in situ	<i>Upper limit:</i> None set <i>Lower limit:</i> Dead wood present in at least 2 forms within a 25m radius of a sample point*
A9. Evidence of browsing	Signs of browsing particularly on saplings (where tops have been taken off) or ferns (where fronds/pinnae have been removed)	No limits set
A10. Evidence of bark stripping by squirrels	Signs of bark stripping by squirrels	No limits set
* Sampling points as defined in Wilkinson, K. (17 February 2004) Cardiff Beech Woods cSAC, Annex 1 Habitat (9180) <i>Tilio-Acerion</i> forests of slopes, screes and ravines, SAC Monitoring Report (draft)		
Performance indicators for factors affecting the feature		
Factor	Factor rationale and other comments	Operational Limits
F1. Recreational Use	The woodlands, especially Castell Coch and Fforestganol a Chwm Nofydd, experience heavy recreational pressure and certain areas are managed for this purpose. Health and safety considerations (discussed below) are relevant here.	No limits set. Pending a fuller understanding of current situation and impact on habitat. Access issues need to be kept under review.
F2. Health & safety	In addition to general health and safety issues arising from woodland management for conservation purposes, site-specific safety issues need to be addressed by management. Such issues may arise from the presence of old quarry workings, and 'unsafe' trees in vicinity of public footpaths, access routes and car parks etc.	No limits set.
F3. Atmospheric pollution	The location of the woodland in industrialised South Wales, together with the presence of nearby quarrying and associated activities, means that there is the potential for localised atmospheric pollution.	No limits set. There is no evidence to date that this has had an adverse impact on the features but this may need to be addressed in more detail in the future.
F4. Development	Its location in the populated South Wales area means that there is considerable development pressure in the vicinity including associated infrastructure on land adjacent to the site. There is the potential for a range of impacts arising from increasing urbanisation.	No limits set. May need to be considered in the future.
F5. Commercial forestry	Commercial forestry in the vicinity of Castell Coch may have implications for	No limits set. Pending a fuller understanding of current situation

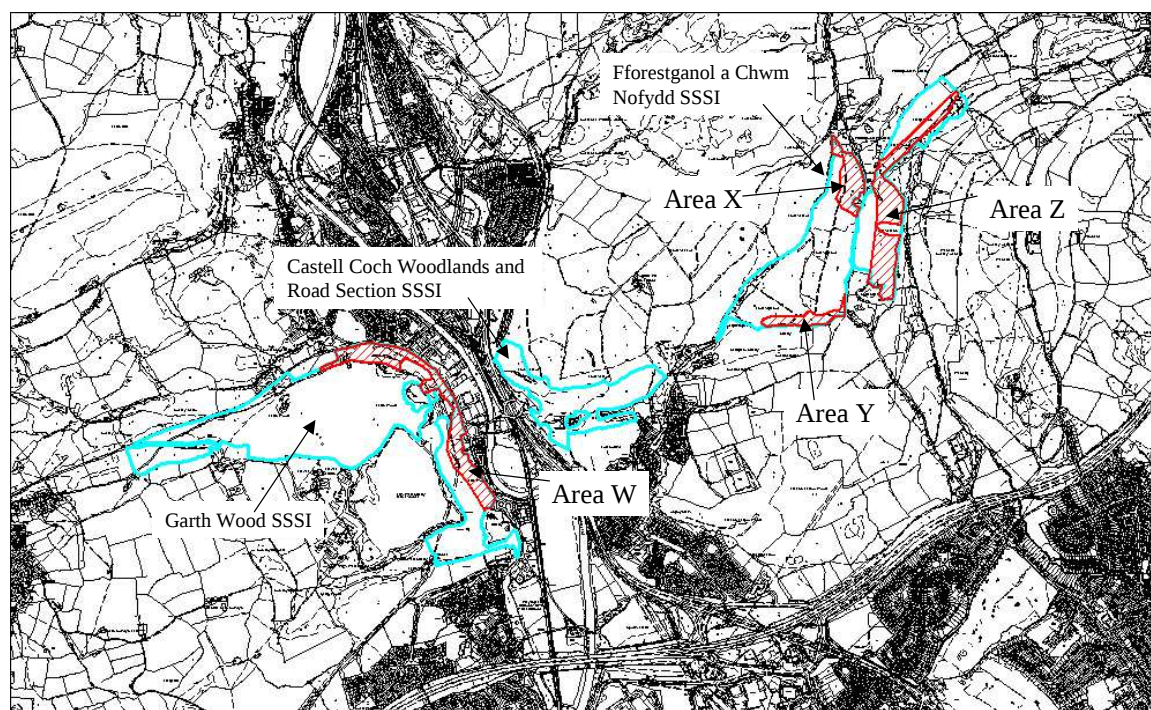
	surface water supply and quality, and this needs to be kept under review.	and impact on habitat.
F6. Mineral extraction	There are a number of active and disused limestone quarries in the area. Garth Wood surrounds Taff's Well Quarry but there are other, smaller quarries in and around all the component SSSIs. Quarrying can lead to direct loss of the feature together with indirect impacts from issues such as access. There are also a number of impacts arising from restoration at the end of a quarry's working life. (For aerial impacts see atmospheric pollution above.)	No limits set. Pending a fuller understanding of current situation and impact on habitat. Quarry restoration may need to be considered in the future.
F7. Cultural heritage	There is considerable cultural heritage interest in the area, including Castell Coch and industrial workings. The associated health and safety issues are addressed above. The management of these sites needs to be balanced with the requirements of the conservation objectives.	No limits set.

Map 1:
Location of *Tilio-Acerion* Habitat (Areas W, X, Y and Z) at Cardiff Beech Woods SAC



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Map 2:
Rights of Way through Cwm Nofydd



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5. MANAGEMENT OBJECTIVES FOR SSSI-ONLY FEATURES

Conservation objectives for SSSI features are not covered by the requirements of the Habitat Regulations which relates to features of international sites.

The following visions and performance indicators for SSSI features will be used to guide the SSSI management.

5.1 Conservation Objective for Feature 3: Semi-natural Broadleaved Woodland

Vision for feature 3

As for features 1 and 2.

Performance indicators for feature 3

Semi-natural broadleaved woodland is a feature of all three SSSIs underpinning the SAC.

<i>Performance indicators for feature condition</i>		
<i>Attribute</i>	<i>Attribute rationale and other comments</i>	<i>Specified limits</i>
A1. Extent	Upper limit – restricted by the limits set in the conservation objectives for features 1 and 2. Lower limit - based on current extent.	<i>Upper limit:</i> No detrimental impact on features 1 or 2 <i>Lower limit:</i> As existing
A2. Quality	<i>Castell Coch</i> All the woodland within Castell Coch Woodlands and Road Section SSSI is referable to <i>Asperulo-fagetum</i> , so ‘Good condition <i>Asperulo-fagetum</i> woodland of Castell Coch definition’ and ‘ <i>Asperulo-fagetum</i> forest definition’ for feature 1 apply. <i>Fforestganol a Chwm Nofydd</i> Within the SAC ‘Good condition <i>Asperulo-fagetum</i> woodland of Garth Wood definition’ for feature 1, ‘ <i>Tilio-acerion</i> forest definition’ for feature 2 and ‘good condition semi-natural broadleaf woodland’ set out in feature 2 all apply. For those parts outside the SAC ‘good condition semi-natural broadleaf woodland’ applies. <i>Garth Wood</i> All the woodland within Garth Wood is within the SAC, so ‘Good condition	<i>Upper limit:</i> none set <i>Lower limit:</i> the woodland meets the definition of ‘good condition semi-natural broadleaf woodland’ set out above in feature 2

	<i>Asperulo-fagetum</i> woodland of Garth Wood definition' for feature 1, ' <i>Tilio-acerion</i> forest definition' for feature 2 and 'good condition semi-natural broadleaf woodland' set out in feature 2 all apply.	
Performance indicators for factors affecting the feature		
Factor	Factor rationale and other comments	Operational Limits
As features 1 and 2		

5.1 Conservation Objective for Feature 4: *Porrhoma rosenhaurei* (cave dwelling spider)

Although within the SAC boundary, the vision and performance indicators for this SSSI feature are unlikely to impact on the qualifying features 1 and 2 of the SAC. There is limited information on the extent or requirements for this spider. The following vision and performance indicators are therefore of a general nature reflecting our current knowledge and likely to change when more information is available.

Vision for feature 4

- The population of the nationally rare cave spider *Porrhoma rosenhaueri* will be maintained at its current level and distribution throughout the cave systems of Lesser Garth Cave.
- General conditions favourable to the cave invertebrate fauna of Lesser Garth Cave will be maintained.
- All factors affecting the achievement of these conditions are under control.

Performance indicators for feature 4

Performance indicators will be used to guide the SSSI management for this feature.

Performance indicators for feature condition		
Attribute	Attribute rationale and other comments	Specified limits
A1. Extent	For a species feature to be considered to be in favourable condition, sufficient habitat must exist to support the population in the long term. See Carter & Mann, 1997, for details of extent of cave system.	<i>Upper limit:</i> None set <i>Lower limit:</i> As existing
A2. Quality	Although there is information on the extent of the cave system, there is little knowledge about the quality of the cave habitat required to support the feature	<i>Upper limit:</i> To be determined <i>Lower limit:</i> To be determined
A3. Size of population	For a species feature to be considered to be at favourable conservation status, the size of the population must be maintained or increased. Some information on the species at this location is contained in Carter & Mann, 1997, but this baseline is yet to be confirmed.	<i>Upper limit:</i> To be determined <i>Lower limit:</i> To be determined

Performance indicators for factors affecting the feature		
Factor	Factor rationale and other comments	Operational Limits
F1. Recreational Use	Garth Wood experiences some recreational pressure and access to the caves is restricted. However, caving does occur and needs to be kept under review. Health and safety considerations are relevant here. Carter & Mann, 1997, felt that cavers were affecting the distribution of the spider by eliminating it from narrow sections of the cave where people tend to rub against the wall. However, the level of disturbance the spider can tolerate and still maintain a viable population is unknown.	<i>Upper limit:</i> To be determined <i>Lower limit:</i> To be determined
F2. Health & safety	Site-specific safety issues which may arise from the presence of the caves and old quarry workings need to be addressed by management.	<i>Upper limit:</i> To be determined <i>Lower limit:</i> To be determined

5.3 Conservation Objective for Feature 5: Geological Exposures

Vision for feature 5

- The rock layers are sufficiently free from soil, vegetation or other covering for them to be seen and to see how each layer relates to the layers above and below in the sequence.
- The rocks are clean and accessible in key areas within the site and this is sustainable in the long term.
- All factors affecting the achievement of these conditions are under control.

Performance indicators for feature 5

Performance indicators will be used to guide the SSSI management for this feature.

Performance indicators for feature condition		
Attribute	Attribute rationale and other comments	Specified limits
A1. Extent	The rock outcrop to be of sufficient quantity and distribution to enable a full understanding of the feature. Upper limit – restricted by the limits set in the conservation objectives for features 1 and 2. Lower limit - based on current extent.	<i>Upper limit:</i> No detrimental impact on features 1 or 2 <i>Lower limit:</i> As existing
A2. Quality	The rock outcrop to be of sufficient quality to enable a full understanding of the feature.	<i>Upper limit:</i> None required <i>Lower limit:</i> As existing

<i>Performance indicators for factors affecting the feature</i>		
<i>Factor</i>	<i>Factor rationale and other comments</i>	<i>Operational Limits</i>
Natural Woodland Processes	Growth of scrub and other vegetation on the rock face/ledges and floor has the potential to cover the exposures.	None set.
Natural Erosion and Deposition Processes	Weathering and erosion of the rock face, mass movement of scree, wash of soil from the top of exposures, solution, and karstification may also cover the exposures. This can be followed by growth of vegetation.	None set.
Recreational Use	The road section is becoming increasingly popular for climbing and fixed rock anchors have been attached to the rock face in places.	No limits set. Although this is unlikely to be a problem for the geological part of the site, this will be kept under review.

6. ASSESSMENT OF CONSERVATION STATUS AND MANAGEMENT REQUIREMENTS

This part of the document provides:

- A summary of the assessment of the conservation status of each feature.
- A summary of the management issues that need to be addressed to maintain or restore each feature.

6.1 Conservation Status and Management Requirements of Feature 1:

***Asperulo-Fagetum* beech forest (EU Habitat Code 9130)**

Conservation Status of Feature 1

The sites were monitored in March 2004 to gather the extent or condition of the habitat. The current feature status for the *Asperulo-fagetum* beech forest is **Unfavourable - Unclassified** (March 2004).

The justification for the above feature status (March 2004) is as follows:

CCW view is that the site is still recovering from undesirable effects of past management. Although most if not all aspects of the component sites are heading in the right direction the status is still short of favourable. Implementation of appropriate management will be addressed but in our view there is no urgent or immediate need for action.

The Garth Wood component is thought to be 'unfavourable unclassified'. The management is mostly limited intervention and for most of the site there is good age structure and gap regeneration. Natural processes could be enhanced by localised intervention and this will be addressed through management recommendations.

Fforestganol a Chwm Nofydd is thought to be 'unfavourable unclassified. Although there are small areas of even age structure there is generally a diverse age structure. This, together with concerns at the percentage of beech at some locations, will be addressed through management recommendations.

Castell Coch Woodlands and Road Section is thought to be 'favourable'. There is generally an even age structure with low canopy cover. However, there is evidence of natural woodland processes, with good regeneration within the pattern of gaps. Recovery is expected over time and this could be hastened with increased localised intervention. This, together with concerns over the species composition (particularly ash and sycamore) at some locations will be addressed through management recommendations.

Please refer to the following report for further details:

Wilkinson, K. (17 March 2004) Cardiff Beech Woods cSAC, Annex 1 Habitat (9130) *Asperulo-Fagetum* beech forests SAC Monitoring Report (draft).

Management Requirements of Feature 1

The following summarises the current management requirements of the feature based on the current feature status for the *Asperulo-fagetum* beech forest (March 2004).

It is very important to recognise that management may need to change with time. Problems that we are aware of today may be resolved or completely removed and new unforeseen problems may arise. New improved management techniques may also become available. Consequently the management outlined in this document is considered appropriate for the short term but may need to change in the long term.

Woodland Management

The management policy of minimal intervention allows natural woodland processes to continue and wildlife to flourish. Tree falls create canopy gaps to encourage natural regeneration. All safely fallen trees should be left where they fell wherever possible and standing dead wood retained in situ.

The presence of a number of species considered to be non-native e.g. sycamore and Japanese knotweed, will be kept under review. Control measures may be required if monitoring indicates any detrimental effects on the woodland communities of special interest.

The long term aim for the woodlands is to apply minimal management and allow gap creation to occur naturally as a result of woodland processes. CCW will continue to work with the Forestry Commission, Cadw and Cardiff County Council in this regard.

Localised intervention in certain areas could enhance natural processes, for example:

- o Garth Wood – removal of pine species in areas previously managed as high forest to encourage natural regeneration of native species.
- o Castell Coch Woodlands –review percentage of ash and sycamore in certain locations with selective felling if required. In areas experiencing high levels of bark stripping and other damage, squirrel control may need to be considered.
- o Fforestganol a Chwm Nofydd – selective thinning within areas of even age structure to break up uniformity where appropriate. Review percentage of beech in certain locations.

Please refer to Section 6 for the Action Plan, which assesses the specific management actions required on each management unit.

Recreational Management

All component SSSIs are used to a greater or lesser extent for recreation purposes. Castell Coch Woodlands and Fforestganol a Chwm Nofydd experience the most recreation pressure, and are popular for walking, climbing and mountain biking.

The Taff train runs through part of the Castell Coch Woodlands site and the historic building of Castell Coch attracts many visitors, which increases the access pressure on the woodlands. The road section is becoming increasingly popular for climbing, and this is unlikely to be a problem for the geological interest of the site. However, climbing could be potentially damaging to trees at the top of the crag and needs to be kept under review.

Fforestganol a Chwm Nofydd Local Nature Reserve also attracts a significant number of visitors.

Management of access is nominally through the individual site owners but there are potential conflicts between different users which to date have been addressed through the Local Authority Access Forum. Access issues need to be kept under review.

There is pressure to open up additional areas for access, with potential adverse implications for the ground flora and, depending on the scale of the proposals, the trees themselves. Again, this needs to be kept under review and advice provided through the relevant strategic planning processes and user groups.

CCW will continue to work with Cardiff County Council to ensure that the Taff Trail has no adverse affects on the habitat feature. CCW will also work with the climbing clubs and Cardiff County Council to ensure the trees alongside the Castell Coch Road Section are unaffected by climbing and other activities.

Management of the recreational use of the woodlands should focus on maintaining the network of public footpaths and access routes. Regular maintenance of the footpaths and bridleways is essential to stop them spreading onto the adjacent woodland habitat. By restricting recreational use of the woodlands to certain areas and paths, natural woodland processes can be left to occur away from these areas of recreational use and without the need for intervention from a public health and safety perspective.

A balance is sought between managing the recreational use, cultural heritage value and nature conservation importance of the woodlands. CCW will continue to work with the Forestry Commission, Cadw and Cardiff County Council in this regard.

Please refer to Section 6 for the Action Plan, which assesses the specific management actions required on each management unit.

6.2 Conservation Status and Management Requirements of Feature 2: *Tilio-Acerion* forest of slopes, screes and ravines (EU Habitat Code 9180)

Conservation Status of Feature 2

The sites were monitored in February 2004 to gather the extent or condition of the habitats and the species. The current feature status for the *Tilio-Acerion* forest of slopes, screes and ravines is **Unfavourable - Recovering** (February 2004).

The justification for the above feature status (February 2004) is as follows:

CCW view is that the site is still recovering from undesirable effects of past management. Although most if not all aspects of the component sites are heading in the right direction the status is still short of favourable. Implementation of appropriate management will be addressed but in our view there is no urgent or immediate need for action.

The Garth Wood component is thought to be 'unfavourable recovering'. The management is mostly limited intervention and for most of the site there is good age structure and gap regeneration. Natural processes could be enhanced by localised intervention and this will be addressed through management recommendations.

Fforestganol a Chwm Nofydd is thought to be 'unfavourable recovering'. Although there are small areas of even age structure there is generally a diverse age structure. This, together with concerns at the percentage of beech at some locations, will be addressed through management recommendations.

Please refer to the following report for further details:
Wilkinson, K. (17 February 2004) Cardiff Beech Woods cSAC, Annex 1 Habitat (9180) *Tilio-Acerion* forests of slopes, screes and ravines, SAC Monitoring Report (draft)

Management Requirements of Feature 2

The following summarises the current management requirements of the feature based on the current feature status for the *Tilio-acerion* forest of slopes, screes and ravines (February 2004).

It is very important to recognise that management may need to change with time. Problems that we are aware of today may be resolved or completely removed and new unforeseen problems may arise. New improved management techniques may also become available. Consequently the management outlined in this document is considered appropriate for the short term but may need to change in the long term.

Woodland Management

Much of the areas described as true *Tilio-acerion* occur on steep rocky ground, particularly in Garth Wood where it is not possible, for health and safety reasons, to undertake any management.

The management policy of minimal intervention applies to areas supporting *Tilio-acerion* habitat, allowing natural woodland processes to take place. CCW will continue to work with the Forestry Commission, Cadw and Cardiff County Council in this regard.

Recreational Management

Recreation within the areas supporting this habitat feature is restricted due to the steep and rocky nature of the terrain. Therefore the recreational pressure on areas of *Tilio-acerion* is less than on areas of *Asperulo-fagetum* habitat. Nonetheless, given the high recreation pressure experienced by Fforestganol a Chwm Nofydd, which supports areas of *Tilio-acerion* habitat, aspects of recreational management still apply to this feature.

As discussed above for the *Aperulo-fagetum* feature, management of the recreational use of the woodlands should focus on maintaining the network of public footpaths and access routes. By restricting recreational use of the woodlands to certain areas and paths, natural woodland processes can be left to occur away from these areas of recreational use and without the need for intervention from a public health and safety perspective.

A balance is sought between managing the recreational use, cultural heritage value and nature conservation importance of the woodlands. CCW will continue to work with the Forestry Commission, Cadw and Cardiff County Council in this regard.

Please refer to Section 7 for the Action Plan, which assesses the specific management actions required on each management unit.

6.3 Conservation Status and Management Requirements of Feature 3: Semi-natural Broadleaved Woodland

Conservation Status of Feature 3

Castell Coch

All the woodland within Castell Coch Woodlands and Road Section SSSI is referable to *Asperulo-fagetum*, therefore it is possible to derive the condition of the woodland SSSI feature from the work undertaken as part of the 2004 monitoring for the SAC. The woodland feature is therefore considered to be in favourable condition.

Fforestganol a Chwm Nofydd

Less than 50% of the woodland within this SSSI lies within the SAC. Therefore significant additional monitoring of the non-SAC areas is required before the condition can be fully determined. However, in 2004 Unit 4 failed to meet the definition of 'good condition semi-natural broadleaved woodland'. Based on this and survey work undertaken as part of the SSSI renotification process, we therefore consider that as a whole the SSSI is unfavourable-recovering.

Garth Wood

The majority of Garth Wood SSSI lies within the SAC. Therefore some additional monitoring of the non-SAC areas is required before the condition can be fully determined. However, it is possible to derive the condition of the woodland SSSI feature from the work undertaken as part of the 2004 monitoring for the SAC. The woodland feature is therefore considered to be in 'unfavourable recovering'.

Management Requirements of Feature 3

As per features 1 and 2.

The overall management policy is one of minimal intervention. It is anticipated that allowing the natural woodland processes to continue will achieve the conservation objectives for the site.

6.4 Conservation Status and Management Requirements of Feature 4: *Porrhoma rosenhaurei* (cave dwelling spider)

Conservation Status of Feature 4

To be determined.

Management Requirements of Feature 4

It is very important to recognise that management may need to change with time. Problems that we are aware of today may be resolved or completely removed and new unforeseen problems may arise. New improved management techniques may also become available. Consequently the management outlined in this document is considered appropriate for the short term but may need to change in the long term.

Recreational Management

The entrance to Lesser Garth Cave is currently open, allowing free access. Human disturbance is largely limited to the cave entrance and the first sections of the passage; this disturbance may have adverse effects on the environmental conditions within the cave. A gated grille over the entrance will be required to control public access to the cave, minimizing human disturbance. The grille must be suitable to allow access to the cave by bats.

6.5 Conservation Status and Management Requirements of Feature 5: Geological Exposures

Conservation Status of Feature 5

To be determined.

Management Requirements of Feature 5

Recreational Management

The road section is becoming increasingly popular for climbing. Although this is unlikely to be a problem for the geological part of the site, this will be kept under review.

Vegetation Management

The natural processes of erosion and deposition can cause debris to build up over the rocks, and this can be followed by growth of vegetation. This process means the rocks can become completely covered and inaccessible. The cleaning of certain areas of the site has been undertaken in the past and this work will be periodically undertaken again. The current lack of vehicular access means that such work has to be done by hand.

Management may be needed to maintain the exposures if monitoring indicates any detrimental effects on the geological features.

CCW will continue to work closely with Cardiff County Council, Forestry Commission and Welsh Assembly Government on any management required to keep the road section clear and observable.

7. ACTION PLAN: SUMMARY

This section takes the management requirements outlined in Section 5 a stage further, assessing the specific management actions required on each management unit. This information is a summary of that held in CCW's Actions Database for sites, and the database will be used by CCW and partner organisations to plan future work to meet the Wales Environment Strategy targets for sites.

Unit Number	CCW Database Number	Unit Name	Summary of Conservation Management Issues	Action needed ?
1	000330	FCN 1 (Fforestganol)	Owned by Cardiff County Council. The woodland has been managed for some time for nature conservation. Selective thinning, removal of sycamore and ride creation have occurred in the past. The current policy is one of minimal intervention. There are areas of semi-natural woodland and plantation where all the trees are of similar age and there is little regeneration. Selective thinning in these areas may be required, to increase the age structure. A review of the percentage of beech present should be undertaken in certain locations. Heavy recreational pressure by walkers, cyclists and horse-riders is experienced in this unit.	Yes
2	000331	FCN 2 (Cwm Nofydd - Cefncarnau-fawr Farm)	The unit is in private ownership, comprising a small area in the north of the site. The unit does not experience the heavy recreational pressure of adjacent units. The current policy for woodland management is one of minimal intervention. Where all the trees are of similar age and/or there is little regeneration, selective thinning may be required to increase the age structure.	Yes
3	000332	FCN 3 (Cwm Nofydd - north)	Owned by Cardiff County Council. The woodland has been managed for some time for nature conservation. Selective thinning, removal of sycamore and ride creation have occurred in the past. The current policy is one of minimal intervention. There are areas of semi-natural woodland and plantation where all the trees are of similar age and there is little regeneration. Selective thinning in these areas may be required. A review of the percentage of beech present should be undertaken in certain locations. Heavy recreational pressure by walkers, cyclists and horse-riders is experienced in this unit.	Yes
4	000333	FCN 4 (Cwm Nofydd - south)	Owned by Cardiff County Council. The woodland has been managed for some time for nature conservation. Selective thinning, removal of sycamore and ride creation have occurred in the past. The current policy is one of minimal intervention. There are areas of semi-natural woodland and plantation where all the trees are of similar age and there is little regeneration. Selective thinning in these areas may be required. A review of the percentage of beech present should be undertaken in certain locations. Recreational pressure is considered to be less in this unit than in adjacent units.	Yes

Unit Number	CCW Database Number	Unit Name	Summary of Conservation Management Issues	Action needed ?
8	000337	CC 3 (Forestry Commission)	Unit owned by Forestry Commission. The overall management policy is of minimal intervention. All safely fallen trees are left where they fell to increase the dead wood component of the woodland. Trees felled for health and safety purposes (in the vicinity of public footpaths etc.) are left in situ wherever possible. Heavy recreational pressure by walkers, cyclists and horse-riders is experienced and some site-specific health and safety issues need to be addressed by management. There is no evidence that potential aerial pollution from the A470 is having as adverse impact on the features but this may need to be addressed in more detail in the future. Commercial forestry to the north and east of this unit may have implications for surface water supply and quality and should be kept under review.	Yes
9	000338	CC 4 (Castell Coch)	Unit owned by Marquis of Bute and Cadw. The overall management policy is of minimal intervention. All safely fallen trees are left where they fell to increase the dead wood component of the woodland. Trees felled for health and safety purposes (in the vicinity of public footpaths etc.) are left in situ wherever possible. Heavy recreational pressure by walkers, cyclists and horse-riders is experienced and some site-specific health and safety issues need to be addressed by management. There is no evidence that potential aerial pollution from the A470 is having as adverse impact on the features but this may need to be addressed in more detail in the future. Commercial forestry to the north of this unit may have implications for surface water supply and quality and should be kept under review. There is considerable development pressure in the vicinity and a potential range of impacts arising from increasing urbanisation. Squirrel damage has been recorded and is being kept under review. The percentage of ash and sycamore trees is also to be kept under review and consideration given to selective felling if required.	Yes
10	000339	GW 1 (SAC woodland)	Unit in ownership of Quarry company. Much of the woodland appears to have been managed in the past as high forest and includes areas that have been planted with beech and Corsican pine. The current policy is one of minimal intervention. There are area of semi-natural woodland and plantation where all the trees are of similar age and there is little regeneration. Selective thinning of these areas may be required. A review of the percentage of beech present should be undertaken in certain locations. Past and current quarrying in this area has caused disturbance to the habitat and natural colonisation of these areas continues to be encouraged. Health and safety issues also need consideration. There is no evidence to date that potential aerial impacts from the adjacent quarry and A470 have had an adverse impact on the features but this may need to be addressed in more detail in the future. Although footpaths are present along the northern boundary and within the north-west corner of the site, it is considered that this unit experiences less recreational pressure in comparison to other units. Access to Lesser Garth Cave is restricted but caving may cause disturbance to the cave-dwelling spider feature of the SSSI, and needs to be kept under review.	Yes

8. GLOSSARY

This glossary defines some of the terms used in this **Core Management Plan**. Some of the definitions are based on definitions contained in other documents, including legislation and other publications of CCW and the UK nature conservation agencies. None of these definitions is legally definitive.

Action	A recognisable and individually described act, undertaking or project of any kind, specified in section 6 of a Core Management Plan or Management Plan , as being required for the conservation management of a site.
Attribute	A quantifiable and monitorable characteristic of a feature that, in combination with other such attributes, describes its condition .
Common Standards Monitoring	A set of principles developed jointly by the UK conservation agencies to help ensure a consistent approach to monitoring and reporting on the features of sites designated for nature conservation, supported by guidance on identification of attributes and monitoring methodologies.
Condition	A description of the state of a feature in terms of qualities or attributes that are relevant in a nature conservation context. For example the condition of a habitat usually includes its extent and species composition and might also include aspects of its ecological functioning, spatial distribution and so on. The condition of a species population usually includes its total size and might also include its age structure, productivity, relationship to other populations and spatial distribution. Aspects of the habitat(s) on which a species population depends may also be considered as attributes of its condition.
Condition assessment	The process of characterising the condition of a feature with particular reference to whether the aspirations for its condition, as expressed in its conservation objective , are being met.
Condition categories	The condition of feature can be categorised, following condition assessment as one of the following²: Favourable: maintained; Favourable: recovered; Favourable: un-classified Unfavourable: recovering; Unfavourable: no change; Unfavourable: declining; Unfavourable: un-classified Partially destroyed; Destroyed.

² See JNCC guidance on Common Standards Monitoring <http://www.jncc.gov.uk/page-2272>

Conservation management	Acts or undertaking of all kinds, including but not necessarily limited to actions , taken with the aim of achieving the conservation objectives of a site. Conservation management includes the taking of statutory and non-statutory measures, it can include the acts of any party and it may take place outside site boundaries as well as within sites. Conservation management may also be embedded within other frameworks for land/sea management carried out for purposes other than achieving the conservation objectives.
Conservation objective	The expression of the desired conservation status of a feature , expressed as a vision for the feature and a series of performance indicators . The conservation objective for a feature is thus a composite statement, and each feature has one conservation objective.
Conservation status	A description of the state of a feature that comprises both its condition and the state of the factors affecting or likely to affect it. Conservation status is thus a characterisation of both the current state of a feature and its future prospects.
Conservation status assessment	The process of characterising the conservation status of a feature with particular reference to whether the aspirations for it, as expressed in its conservation objective , are being met. The results of conservation status assessment can be summarised either as ‘favourable’ (i.e. conservation objectives are met) or unfavourable (i.e. conservation objectives are not met). However the value of conservation status assessment in terms of supporting decisions about conservation management , lies mainly in the details of the assessment of feature condition , factors and trend information derived from comparisons between current and previous conservation status assessments and condition assessments.
Core Management Plan	A CCW document containing the conservation objectives for a site and a summary of other information contained in a full site Management Plan .
Factor	Anything that has influenced, is influencing or may influence the condition of a feature . Factors can be natural processes, human activities or effects arising from natural process or human activities, They can be positive or negative in terms of their influence on features, and they can arise within a site or from outside the site. Physical, socio-economic or legal constraints on conservation management can also be considered as factors.
Favourable condition	See condition and condition assessment

Favourable conservation status See **conservation status** and **conservation status assessment**.³

Feature The species population, habitat type or other entity for which a site is designated. The ecological or geological interest which justifies the designation of a site and which is the focus of conservation management.

Integrity See **site integrity**

Key Feature The habitat or species population within a **management unit** that is the primary focus of **conservation management** and **monitoring** in that unit.

Management Plan The full expression of a designated site's legal status, **vision**, **features**, **conservation objectives**, **performance indicators** and management requirements. A complete management plan may not reside in a single document, but may be contained in a number of documents (including in particular **the Core Management Plan**) and sets of electronically stored information.

Management Unit An area within a site, defined according to one or more of a range of criteria, such as topography, location of **features**, tenure, patterns of land/sea use. The key characteristic of management units is to reflect the spatial scale at which **conservation management** and **monitoring** can be most effectively organised. They are used as the primary basis for differentiating priorities for conservation management and monitoring in different parts of a site, and for facilitating communication with those responsible for management of different parts of a site.

Monitoring An intermittent (regular or irregular) series of observations in time, carried out to show the extent of compliance with a formulated standard or degree of deviation from an expected norm. In **Common Standards Monitoring**, the formulated standard is the quantified expression of favourable **condition** based on **attributes**.

Operational limits The levels or values within which a **factor** is considered to be acceptable in terms of its influence on a **feature**. A factor may have both upper and lower operational limits, or only an upper limit or lower limit. For some factors an upper limit may be zero.

Performance indicators The **attributes** and their associated **specified limits**, together with **factors** and their associated **operational limits**, which provide the standard against which information from **monitoring** and other sources is used to determine the degree to which the **conservation objectives** for a **feature** are being met. Performance indicators are part of, not the same as, conservation objectives. See also **vision for the feature**.

³ A full definition of favourable conservation status is given in Section 4.

Plan or project	Project: Any form of construction work, installation, development or other intervention in the environment, the carrying out or continuance of which is subject to a decision by any public body or statutory undertaker. Plan: a document prepared or adopted by a public body or statutory undertaker, intended to influence decisions on the carrying out of projects. Decisions on plans and projects which affect Natura 2000 and Ramsar sites are subject to specific legal and policy procedures.
Site integrity	The coherence of a site's ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it is designated.
Site Management Statement (SMS)	The document containing CCW's views about the management of a site issued as part of the legal notification of an SSSI under section 28(4) of the Wildlife and Countryside Act 1981, as substituted.
Special Feature	See feature .
Specified limit	The levels or values for an attribute which define the degree to which the attribute can fluctuate without creating cause for concern about the condition of the feature . The range within the limits corresponds to favourable, the range outside the limits corresponds to unfavourable. Attributes may have lower specified limits, upper specified limits, or both.
Unit	See management unit .
Vision for the feature	The expression, within a conservation objective , of the aspirations for the feature concerned. See also performance indicators .
Vision Statement	The statement conveying an impression of the whole site in the state that is intended to be the product of its conservation management . A 'pen portrait' outlining the conditions that should prevail when all the conservation objectives are met. A description of the site as it would be when all the features are in favourable condition .

9. REFERENCES AND ANNEXES

References

Carter, J. & Mann, D.J. 1997 Report on the Survey of Lesser Garth Cave, Cardiff, for the trolobitic spider *Porrhomma resenhauri*, Koch (Aranea: Linyphiidae), with notes on other invertebrate species found. National Museum and Galleries of Wales survey report.

Castell Coch Woodlands and Road Section SSSI – Citation

Castell Coch Woodlands and Road Section SSSI – Site Management Statement

Countryside Council for Wales (2007) Site Issues Briefing for Cardiff Beech Woods SAC

Fforestganol a Chwm Nofydd SSSI – Citation

Fforestganol a Chwm Nofydd SSSI – Site Management Statement

Garth Wood SSSI – Citation

Garth Wood SSSI – Site Management Statement

Joint Nature Conservation Committee (JNCC), Cardiff Beech Woods SAC (UK0030109) Site Details
<http://www.jncc.gov.uk/ProtectedSites/SACselection/sac.asp?EUCode=UK0030109>

Wilkinson, K. (17 February 2004) Cardiff Beech Woods cSAC, Annex 1 Habitat (9180) *Tilio-Acerion* forests of slopes, screes and ravines, SAC Monitoring Report (draft)

Wilkinson, K. (17 March 2004) Cardiff Beech Woods cSAC, Annex 1 Habitat (9130) *Asperulo-Fagetum* beech forests SAC Monitoring Report (draft)

Annexes

Annex A Map of Cardiff Beech Woods SAC

Annex B Map of Cardiff Beech Woods SAC Component SSSI Management Units

Appendix D

Desk Study Summary

D1 Desk Study Summary

Table 6: Summary of protected and notable species records within approximately 2km of the project boundary. Data are predominantly from 2009 onwards. Distances are approximate.

Species/Group	Summary of Records
European Protected Species (EPS)	
Otter	Three records of otter within 2km from 2009 onwards, the closest of which is of recent sightings around Atlantic Wharf, approximately 1.58km west of the project.
Bats	Number of records of bat roosts within 2km from 2009 including: One record of a <i>Pipistrellus spp.</i> roost located approximately 1.2km north. There are numerous records of bat activity, such as commuting and foraging, within 2km from 2009 onwards, including records of common pipistrelle, <i>Myotis spp.</i> , Nathusius' pipistrelle, noctule bat, <i>Nyctalus spp.</i> , <i>Pipistrellus spp.</i> , soprano pipistrelle, and unknown bat species.
Nationally Protected Species	
Schedule 1 birds	Records of 26 Schedule 1 bird species within 2km from 2009 onwards. These include avocet, black redstart, blacktailed godwit, brambling, cetti's warbler, common crossbill, common scoter, fieldfare, goldeneye, great northern diver, green sandpiper, greenshank, kingfisher, little gull, little tern, marsh harrier, Mediterranean gull, merlin, osprey, peregrine, pintail, red kite, redwing, scaup, Slavonian grebe, and whimbrel.
Breeding birds	There are numerous records of birds with the potential to breed within 2km of the project from 2009 onwards. Of these, 41 species are red listed, and 57 species are amber listed by the Welsh and/or UK RSPB.
Badgers	Two records of badger within 2km from 2009 onwards, closest of which is of a scat approximately 322m west.
Reptiles	One record of one individual common lizard within 2km from 2009 onwards, located approximately 769m west of the project.
Other species	Records of 22 Section 7 ²⁰ species. These are buff ermine, cinnabar, dot moth, dusky thorn, garden tiger, ghost moth, grayling, hedgehog, knot grass, lackey, large wainscot, latticed heath, mottled rustic, powdered quaker, rustic, sallow, shaded broad-bar, small blue, small heath, wall, white ermine, and wood bitter-vetch. Records of 53 LBAP ²¹ species including section 7 invertebrates, mammals and amphibians

²⁰ S7 = Listed as a priority species in response to Section 7 of the Environment Act (Wales) 2016

²¹ LBAP = Local Biodiversity Action Plan species for the area

Appendix E

Construction Method Statement

E1 Construction Method Statement

FORM

Method Statement

[illegible]

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Method Statement

Control sheet:

Risk Assessment / Method statement – Tracking Sheet

Name	Job title	Signature	Status	Comments
Simon Fisher	Project Manager		A	none

Review process

No	Prompt List	Yes	No	In Part	N/A
1.	Unique project specific number and title identified for the document?	✓			
2.	Does the method statement / risk assessment include suitable arrangements if sub-sub contractors are involved?				✓
3.	Authorisation and distribution personnel identified?	✓			
4.	Brief overview including location and duration of the works described?	✓			
5.	Specific Risk Assessment † attached and satisfactory? Are all the hazards/environmental impacts identified? Have all the risks been evaluated and controls identified?	✓			
6.	High risk/safety critical / COSHH activities identified / controls specified? (Controls eg – Statutory permits/ licences, Security, Testing / commissioning / special training)	✓			
7.	Scope of works identifying / listing all activities? Philosophy identified? Are all parameters identified / listed?	✓			
8.	Temporary Works schemes identified? Philosophy identified? Temporary work drawings listed including relevant calculations? Permits required? Interfaces identified?	✓			
9.	Names / titles / contact details of key personnel / supervisors responsible?			✓	
10.	Resources identified e.g. personnel, supervision, equipment, plant, materials? Craneage – lifting plan in place? Lifting equipment – plan / certificates in place? Access / scaffolding requirements clearly set out?	✓			
11.	Induction / training / permit requirements identified? Permit issue authorisation regime identified? Daily briefing and toolbox talk regime identified?	✓			
12.	General site requirements identifying access / egress / traffic measures? Details of services / works isolation? PPE / evacuation requirements identified? Welfare / first aid facilities identified?	✓			
13.	Monitoring & compliance Monitoring by whom Enforcement – how by whom- equipment (meters / sampling)				✓

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Method Statement

14.	Interfaces / security of the client / public / other contractors identified?	✓			
15.	Environmental controls / Waste Controller / ECCoP identified?	✓			
16.	QC monitoring and inspection / testing regime identified? I&T Plans refs				✓
17.	Contingency plan e.g. emergency / fire / rescue / spill response identified?	✓			
18.	Any special conditions identified e.g. confined spaces, tidal working	✓			
19.	Management of Change – process in place to identify change requirements	✓			
20.	Review date as required	✓			
21.	Approvals statement incorporated?	✓			
22.	Confirmation of Operatives briefing / Operatives induction sheet incorporated?	✓			
23.	Any other (specify)?				✓
† Any Risk Assessment shall be amended / confirmed as site specific. * Status A Work can proceed as described B Work can proceed when comments are incorporated C Resubmit and agree before work can proceed					
Comments					
Note Clearance to proceed with this Method Statement does not relieve the Subcontractor of their contractual obligations, including safety, structural integrity or any implications to permanent works arising from these proposals.					

Method Statement

Scheme Title	Cardiff Central District Sewerage Pumping Station
Contractor	Morgan Sindall

This method statement has been developed further to the completion of the following references risk assessments:

Risk Assessment Number	Title
1W6000/4566	Outfall Chamber Modifications

Section 1 – General Details

Scope of Works:
The project involves the removal of silts and sediments from the existing outfall pipe and associated chamber and the installation of a new outfall grille at the opening on to Splott beach. A new access is also to be created in the roof of the outfall chamber to provide access for proposed cleaning and jetting operations. The main parameters' affecting the works are: • Access to the working area is via the Cardiff wastewater treatment works off Tide Fields Road, therefore consideration must be given to treatment works plant and traffic and associated personnel including visitors etc. to the site. • All works on the scheme will be subject to tidal working restrictions. Tide charts will be used to determine appropriate working times.

Prepared by:	Matthew Bennett		
Position held:	Snr Engineer		
Signed:		Date:	03/12/19
Review date:	02/12/20		

Work Supervisor(s);	Matthew Bennett; TBC.
Refer to Method Statement Tracking and Content Sheet	

Section 2 – Programme of Operations

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Method Statement

Start date / time:	May 2020				
Preceding Works to be Completed:	Site Establishment				
Duration:	Approx. 6 Weeks				
Permit required:					
Permit to Work (General)	☐	Permit to Enter (Confined Spaces)	☒	Permit to Dig	☒
Hot Work Permit	☐	Out of Hours Work Permit	☐	Other (specify)	Permit to Lift
All required Permits will be issued by the Morgan Sindall designated person prior to the works commencing.					

Section 3 – Personnel

Include details of all personnel involved in the task and any special training, skills or qualifications required

The designated site personnel will have experience in the activities that they will be undertaking that are covered by this method statement and risk assessment.

Name	Role	Competence Details
Matthew Bennett	Site Manager	CITB – Site Management Safety Training Scheme, CPCS Crane Supervisor (Lifting Operations). Fire Warden Training, First Aid Training, Genny & Cat Training. New Roads and Street Works (Supervisor). Temporary Works Supervisor.
TBC	Ganger	CITB - Site Supervisor Safety Training Scheme, Cat and Genny Radio Detection, Confined Space, CPCS - Forward Tipping Dumper – Wheeled, CPCS - Ride on Roller, CPCS - Slinger/Signaller, First Aid Training. CPCS Excavator 360 Above & Below 10T Tracked.
TBC	Skilled Operative	CPCS Forward/Tipping Dumper, Slinger Signaller, Confined Space, CPCS Excavator 360 Above & Below 10T Tracked.
TBC	Skilled Operative	CAT & Genny Training, CPCS Forward/Tipping Dumper, Slinger Signaller, Confined Space, CPCS Excavator 360 Above & Below 10T Tracked.
TBC	Skilled Operative	CAT & Genny Training, Confined Space, CPCS - Forward Tipping Dumper – Wheeled, CPCS - Ride on Roller, CPCS - Slinger/Signaller.

Section 4 – Safe System of Work to be Adopted

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Method Statement

4.0 Introduction

- 4.0.1 This method statement (MS) outlines initial proposals for this activity. Where it is identified that there is a need to change the method of work due to unforeseen circumstances for example, then revision, authorisation and issue will follow the same procedure as the original. This method statement is only valid when the person who has prepared it and the person who has authorised it have signed the front sheet accordingly.
- 4.0.2 Task Statements (TS) will be developed for specific tasks required to carry out the works, as and when required. The MS and TS should be read in conjunction with the site-specific plan and the construction programme. The MS and TS are “live” documents and will be updated as required, with newly identified risks.
- 4.0.3 The Responsible Person must be in possession of an approved method statement and task statement for the works. The Agent and Foreman / Supervisor shall ensure that the works proceed according to this approved method statement and subsequently developed task statements.

4.1 Risk Assessment

- 4.1.1 See Appendix A.

4.2 Induction / Training

- 4.2.1 All site personnel will be familiarised with the site and made aware of any hazards, by way of a site-specific induction.
- 4.2.2 All operatives working on the tasks described in this method statement, risk assessment and any associated task statement must be briefed on its contents. Operatives must sign the attached briefing attendance sheet to confirm that they have been briefed and understood the contents.
- 4.2.3 Daily briefings shall be given to the operatives prior to work commencing. Tool Box talks will be planned monthly and given to all operatives on a weekly basis. The Morgan Sindall designated person must be in possession of an approved MS and TS before issuing any permits. All operatives must be briefed on the requirements of the permit before work commences.

**Safety Helmets, Safety Footwear,
High Visibility Clothing, Safety Gloves
and Eye Protection MUST be worn
at all times on this site**

4.3 General Site Requirements

- 4.3.1 Access and Egress

Site Address is detailed as below:

Morgan Sindall Compound, Cardiff CDSPS (via Cardiff WwTW), Off Tide Fields Road, Cardiff.

Sign posts shall be displayed in advance to inform drivers of the compound & work access. Any large loads leaving the compound may need a Banksman to control any residential traffic on the adjoining road and ensure that the area is clear of pedestrians and children.

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Method Statement



No reversing without banks man



**Observe the speed limit as specified
on this site**

The main site working hours will be 07:30 – 17:30 Monday to Friday, however these times may change due to tidal working requirements. Weekend working will be by exception and agreed with the Project Manager/ Senior Contracts Manager.

4.3.2 Safety of Services

Any overhead services will be protected by the means of warning posts and bunting following the line of the cables denoting the location of the cables.

Underground services will be clearly marked by using service drawings and a service locator device, and will be protected accordingly if required. A permit to excavate will be issued for all excavations prior to commencement of excavating.

Not all services encountered will be identified from STAT plans and CAT scan- therefore utilise recognised best practice whilst completing all excavations:

No excavations can commence before a Permit to Break Ground has been issued.

No lifting operations can take place before a Control of Lifting Operations Permit has been issued.

4.3.3 Safety Works or Isolation Measures

Working areas will be protected by suitable fencing / barriers. Protection from the public will be provided by Morgan Sindall as necessary. The fencing will be maintained by Morgan Sindall to prevent access during non - working hours. All excavations will be suitably protected at all times and secured out of hours. All Fence panels to be double clipped at all times.



**Danger
Construction site hazardous area**



Children must not play on this site

4.3.4 Site office, welfare and first aid facilities

A car parking area will be clearly defined along with pedestrian walkways and a dedicated smoking area. Where possible sewage effluent from the toilets to a grey tank shall be provided and emptied on a regular basis. Water required for the welfare unit/canteen shall be obtained from a local hydrant and filled using a towable 1000 litre bowser. A pump shall then be used to supply water to the toilet block and the canteen. If necessary, perimeter fencing shall be erected around the compound using Heras fence panels. Site fencing shall be double clipped and relevant signage shall be put up on panels. Once the site comes to a close the fence panels shall then be stripped and stock piled ready for collection.

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4.4 Interface Issues

- 4.4.1 The site compound and construction site is accessed via the existing road through Cardiff Wastewater Treatment Works. Therefore, when travelling to and from site, all drivers should be aware of the presence of other road users, pedestrians and any other process plant or equipment working in the area. Delivery wagons shall be directed out of the compound by a designated Vehicle Banksman. The scheme is located in a sensitive location and the proposed works must be planned and coordinated thoroughly with good communication maintained so that any disruption caused is kept to a minimum.

The following measures will be implemented and maintained to protect site operatives and the general public both on site and within the site compound.

1. Site Fencing – To prevent unauthorised access to the site, whether intentional or unintentional. The public footpath will be maintained throughout the works.
2. Appropriate signage: To warn both the public and site operatives about potential hazards associated with the works.
3. Appropriate site communication between operatives and plant operators (Banksman/Slinger-Signaller, Voice and hand signals).
4. It is anticipated that all excavation work shall be open cut with the pebbles battered to a safe angle of repose. Should it be deemed necessary, appropriate temporary works shall be used to prevent potential trench collapse and consequent possible harm to operatives, the public, services and infrastructure.
5. Appropriate edge protection – To prevent anyone or anything from falling into excavations or openings/chambers, and to protect anyone or anything (i.e. services) in the excavation from falling objects.
6. Where entry to the excavation is required, then access and egress will be via a suitable secured ladder which is in a good condition and which displays the current safety tag.
7. Where applicable, fuel bowzers will be bunded to prevent contamination of the ground. Where refuelling is carried out using jerry cans, then drip trays, spill kits and a suitable fire extinguisher will be to hand.
8. Noise alleviation measures if necessary to reduce the exposure of nearby properties to excessive noise.
9. Appropriate fire prevention equipment will be available on site (see 7 above).
10. A photographic pre-condition survey has been undertaken in the location of the compound and surrounding areas that the construction works will be undertaken within.

4.5 Methodology

If any of the methodology or construction sequence detail below should change, STOP works immediately, make safe and report to the site supervision.

4.5.1 Preliminary Instructions

- Prior to Any Excavation work being undertaken A full CAT and Genny survey utilising the supplied STAT plans will be undertaken to identify any services located in the area and then a permit to excavate will be issued and authorised by the appropriate persons prior to any excavation. If required trial holes will be undertaken to find the location of any services.
- Main lifting on the project will primarily be undertaken by the on-site excavator. A valid lift plan will be compiled and completed by an authorised CPCS appointed person complete with a schedule of lifts. All slinging of equipment will be undertaken by a CPCS certified slinger/signaller. The excavator driver must also hold a valid CPCS card and be competent in the proposed works to be undertaken.
- All lifting chains and equipment will have current test certificates and shall display the current colour coded lifting tag. A copy of the test certificates will be held in the site file.

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- A Delivery Lifting Plan & Lorry Loader Checking Form must be completed prior to any delivery offloading on site and the supplier must also have a safe system of work for off-loading.
- The majority of the excavation work will be completed by mechanical means in the form of a 360-degree excavator. No mechanical excavation or sharp pointed tools will be permitted within 0.5 meters of any known service. If any services are discovered that were previously unforeseen or lay undetected, excavation will cease whilst further trial hole investigations are carried out. Any services uncovered will be assumed to be LIVE until written confirmation has been received from the service provider that can confirm otherwise.
- All movements by any machine will be carried out under the supervision of nominated and trained Banksman. All operators of plant will be certified, competent and trained with CPCS qualification.
- All working areas will be segregated from pedestrians and vehicular traffic movements at all times. This will be by means of erecting signing and physical guarding in the form of pedestrian barriers/Heras fencing. Clear warning signs will be attached to the barriers to warn people of the inherent dangers within the work area.

4.5.2 Phase of Works

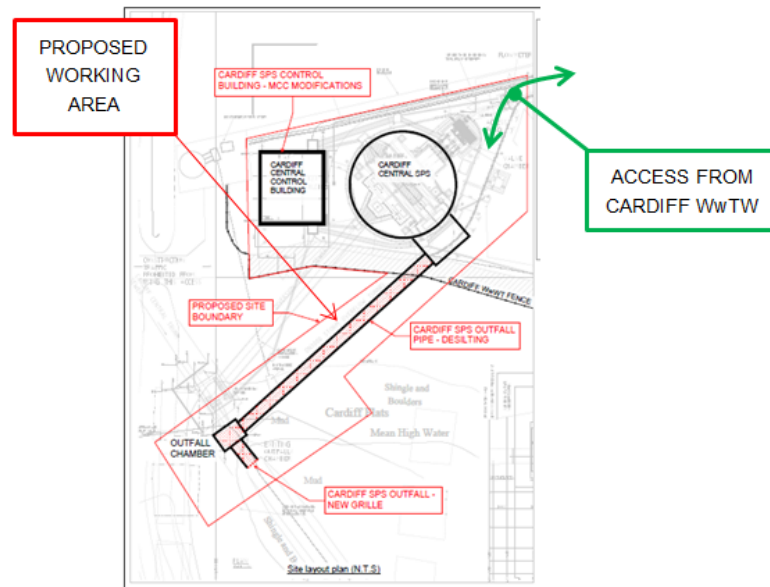
Access:



- A suitable access to the works area will need to be established to allow plant and materials to be delivered. This shall be provided via the existing access road through Cardiff WwTW (Tide Fields Road), see above and below:

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Cleaning/De-Silting:

- 4.5.3
- Excavation/clearance of silt from the mouth of the existing outfall pipeline will be dictated by the tidal conditions and any works associated with the outfall will be carried out to suit the low tide conditions. Upon consulting the Tide Tables for Cardiff a suitable working window will be established.
- 4.5.4
- Access on to the beach will be via the existing ramp from the upper path as indicated below.



- 4.5.5
- A 20/30t tracked excavator will be situated on the bank to the east of the outfall outlet and will be used to clear approx. 1m depth of debris/silt/sediment from the mouth of the outlet to enable subsequent jetting clearing to be removed from the opening and the associated outfall pipe. Excavated material will be deposited back onto the foreshore for natural dispersion.

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Method Statement



- 4.5.6
- When the required material has been removed from the mouth of the outlet pipe, an access opening will need to be made into the top of the existing outfall flow diversion chamber.
- 4.5.7
- Scaffolding will be erected to the perimeter of the chamber to form edge protection for proposed works on the concrete cover slab of the chamber. This will be erected by a competent subcontractor strictly in accordance with their pre-approved risk assessment and method statement.
- 4.5.8
- To enable the jetting and cleaning of the outfall pipe from the pumping station back to the outfall chamber section of the existing concrete slab will be temporarily removed, see below:



- 4.5.9
- Temporary lifting accessories will be installed within the existing slab to enable the slab to be lifted off using the excavator and temporarily stored in a safe location on site for replacement on completion of the cleaning works. To facilitate safe lifting operations, the area that the excavator will sit will need to be levelled out using the machine and will be subsequently re-graded to the original profile on completion.
- 4.5.10
- All access to the outfall chamber and the outfall pipe will be strictly in accordance with Morgan Sindall confined space entry procedures. Works will be closely managed as cleaning works will not be possible during wet weather due to the likelihood of storm spills from the pumping station.
- 4.5.11
- The jetter will be inserted into the chamber through the new opening and used to jet sediment from the pipe towards and out of, the outfall location.
- 4.5.12
- It is proposed to utilise final effluent from Cardiff WWTW in the jetting equipment to mobilise the naturally deposited estuarine silts which will be allowed to disperse in to the Severn estuary from where they have originated.

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4.6

Installation of New Outfall Grille:

4.6.1

- When the outfall pipe has been sufficiently cleaned a new safety grille is to be fabricated and fitted into the outfall opening, example below:



Proposed outfall grille

4.6.2

- The new grille will be delivered to site and off-loaded as necessary. The attendant tracked excavator will then be used to lift the new grille into position complete with appropriate lifting equipment and strictly in accordance with the associated lift plan.

4.6.3

- When in position the grille will be fixed/secured in place as per the manufacturers recommendations. Access to drill and secure the grille will require the use of podium steps.

4.7

Re-fuelling area

The site will be established using a suitably sized bunded fuel bowser with spill kits available. Where practicable a designated diesel refuelling area shall be established in the compound to minimise the risk of any spills around site. This designated refuelling area shall be as far from any water course as is possible. If required a smaller towable bowser shall be used to fill plant on Site. No refuelling operations will take place within 20m of the beach. A spill response kit shall accompany the bowser at all times.

Waste and Recycling Skips

4.8

Waste and recycling skips/bins will be installed in accordance with the compound layout drawing and will be delineated by signage.

4.9

Chemicals

All chemicals that are used during the construction works must be evaluated for environmental risk and potential threat to the environment with emergency procedures in place to respond to and mitigate the effects of any incidents.

Designated storage areas have been established for storage of all materials plant and equipment. This will be clearly labelled on the site layout plan.

All chemicals, oils and fuels must be stored within a purpose made container that is in good condition and clearly labelled with its contents. No refuelling operations will take place within 20m of the beach.

Chemicals should be stored in a secure COSHH store to which only authorised persons will have access.

Only remove enough chemical as required for the activity for which it is intended. Chemicals should be discharged over a drip tray when being used.

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Only dispose of waste chemicals as per the manufacturer's recommendations. Oil booms and spill response kits will be kept on site to contain and clean up in the event of a spillage.

All plant to use bio-degradable oils.

4.10 Invasive Species

Invasive species of plant are not present immediately adjacent to the site area, but Japanese Knotweed has been identified approx. 750m away from site. All site members to be aware of the possible presence of invasive species and if they suspect that they may be present, should immediately inform the supervisor. Do not attempt to remove or disturb suspected invasive plants. Should any invasive species be identified in the immediate vicinity an action plan will be development to prevent spreading of the plant.

4.11 Dust

For the works proposed, dust is not likely to be an issue however construction dust will not only affect the workforce but due to the site being in close proximity of a public footpath it may affect the public as well. To mitigate this - Dust suppression will be used at all times when cutting with disc cutters by means of a proprietary water bottle. FFP3 Masks should be used as a minimum when cutting with disc cutters

During dry conditions on site water bowsers will be employed to reduce the amount of dust created by plant movements.

4.12 Muddy Roads and Paths

Every effort will be made to ensure that roads and footpaths affected by our works will be kept clean. Where required, signs will be erected warning of potential dirty roads. Road brushes will be employed when required to remove mud on roads caused by construction activities.

Run-off water from our works will be monitored and contained if required, sand bags will be placed around existing gully pots to stop run off entering the beach areas.

4.13 Noise

Some of the equipment being used on this scheme will inevitably create noises and we will ensure we work within sociable hours. Equipment will be sited so as not to create undue nuisance and will help limit noise levels by sourcing low noise emitting plant and equipment where possible.

4.14 Light

Working hours will be restricted to daylight hours only.

Any site lighting must face away from the beach, there will be no lighting left on out of working hours.

4.15 Work on beach and embankment

All trees, hedges and shrubs within or adjacent to the site, shall be protected from damage during construction work by the erection of 'Heras' fencing. Wherever possible the removal of any flora will be limited and removal will only be carried out with the prior approval of the SHEQ Advisor and relevant authority.

The beach will be excavated locally to allow for access to the outfall ensuring only the minimum amount of ground is disturbed. As the beach outfall is tidal our works will be below high water level at times. Plant and construction materials shall be removed from the beach to avoid damage or being dispersed by high water.

All activities will be carried out in daylight hours and will not require artificial lighting of any kind. Overnight lighting will not be required.

Statutory Undertaker	Additional Info.	Number
Openreach (BT)	Urgent repairs and defective apparatus.	0800 023 2023
WPD	Emergency	0800 052 0400
Wales & West Utilities	Emergency	0800 111 999

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DCWW Pollution Helpline	Sewerage	08000 853968
DCWW Control Room	General Enquiries	08000 520130

Section 5 – Plant, Equipment

Match plant and equipment to qualified personnel and include any specific PPE details.

The following plant and equipment will be used at various times during this operation:-

Plant, equipment and lifting equipment will only be used by operators who are authorised, trained and have CPCS certification. The operator must inspect all plant and equipment before use and if any damage is found, then it shall be removed from service and the Foreman / Supervisor must be informed.

Plant and Equipment

Equipment description	Test Certificates in date (matched to equipment)	Operator details
20/30t Tracked Excavators c/w various size buckets and lifting gear		CPCS trained and competent operator
Jetvac unit		CPCS trained and competent operator
Lifting Equipment Tagged and Tested		
Associated small tools		
Cat and Genny		

Personal Protective Equipment (PPE)

Equipment description	Specification (e.g. type, grade)	Training required
Fluorescent jackets or waistcoats	(to BS EN 471 Class 2) (Class 3 on high speed roads))	
Safety glasses or goggles	(to BS EN 166-F for general site work)	
Safety helmets	(to BS EN3 97)	
Steel toecapped boots with steel midsole		
Gloves (appropriate for task)		
All Operatives Outerwear Clothing to be IEC 61482-2 Electric Ark Protection for excavations		

Method Statement

Receipt Acknowledgements

Supervisor in charge of the Work

I confirm that I have read and understand the requirements of this method statement and associated risk assessments and will ensure their communication to operatives under my control and to those who may be affected by its requirements

Signed		Date	
Print name		Supervisor	

Communication

Communicate the contents of the Method Statement to all those involved or affected by the works and record their details below.

The following personnel have been inducted in the procedures required to carry out the operations detailed in this Method Statement.

Note: please complete the original MS attendance sheet [copy to be kept in the on-site file original to be returned to Document Control]. Copies of the original MS are to be distributed to the MS holders.

Note to Contractor: whenever the method of work changes you must seek agreement from MORGAN SINDALL before proceeding. Remember to instruct all new starters and get them to sign below.

Name	Job Description	Signature	Date	Employer	Inductor

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FORM

Method Statement

[illegible]

NOTE:

1. If you have any doubt about any information given or contained in this Method Statement – ASK FOR CLARIFICATION.

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			6. In addition to the above, consideration must be given to other individuals' susceptibility due to pre-existing health conditions, e.g. bad back, poor hearing. Additional 'human factors' such as ergonomics, workplace design, etc. should also be considered. 7. Where a hazard is identified that is not listed in the Physical Hazards list, enter the hazard description followed by other in brackets i.e. (Other).		
Hazard no. (from page 1)	Nature of risk (What might go wrong?)	Risk before controls U / A	Control measures (How do you stop it going wrong?)	Control measure implemented by (name)	Risk after controls U / A
31	Working with The Tide Operatives caught out by tide leading to drowning, loss of plant & materials.	U	Tide Timetables to be given to site team, so that they are able to plan their work to ensure that all personnel/plant/materials are off the beach before the tide has turned.	Site Supervisors	A
32	Invasive plant species: Spreading of Japanese Knotweed and Himalayan Balsam etc. resulting in potential prosecution.	U	- Areas containing invasive species to be demarcated and avoided where possible. - Where avoiding contaminated areas is not feasible, works to be minimised as much as possible. Plant and machinery to be washed down before exiting contaminated areas to help prevent spreading. - Excavated contaminated material to be kept within the contaminated area or if not possible on a DPM membrane to prevent spreading. - Excess materials to be disposed of at a suitable and licensed facility.	Site staff, operatives	A
14,31	Interaction with public - Non-Morgan Sindall employees gaining access to the site causing injury to themselves. - Possible death or injury due to falling, tripping and other accidents due to ignorance of the danger on construction sites.	U	- Take all practicable measures to ensure that members of the public cannot gain access to work areas during day or night. - Secure site with 2m high Heras panels. - Provide signs to highlight the dangers present - Security arrangements for site, should also take into account the risk to trespassers	Site Supervisors/ Operatives	A

Safety, Health and Environment Risk Assessment

			- Ensure all excavations are independently fenced within the working area - Appropriate Traffic Management in place.		
6,14,23	Working on construction sites - Slips, trips, falls. - Sprains, strains, broken limbs.	U	- Ensure good housekeeping of working areas. - All personnel to have received an specific project and site induction - Designated storage area for materials	Site Supervisors/ Operatives	A
27	Working with construction plant - Noise and vibration - Ear damage - Environmental impact i.e nuisance noise and damage to properties from vibration - Dust/debris blown into eyes, off cuts of tying wire flying into eyes. - Catching hands on sharp or rough surfaces. - Injuries to eyes, possible blindness. Cuts, lacerations to hands and fingers.	U	- Ensure all plant has noise reduction measures in place and working correctly i.e. baffles, acoustic jackets. - PPM scheme to ensure plant working correctly. - Correct PPE issue and training. - CPCS trained plant operatives. (or similar approved) - Switch off all plant when not in use. - Vibration and noise monitoring during certain operations. - Pre-condition surveys carried out on surrounding structures and areas	Site Supervisors/ Operatives	A
27	Working with construction plant - Dust/debris blown into eyes, off cuts of tying wire flying into eyes. - Catching hands on sharp or rough surfaces. - Injuries to eyes, possible blindness. Cuts, lacerations to hands and fingers.	U	- All personnel must wear safety glasses/goggles and gloves at all times once they enter the working area in addition to the mandatory high visibility clothing, hard hat and safety boots. - Good housekeeping standards	Site Supervisors/ Operatives	A
27	Use of construction plant. Possible crushing of operatives and pedestrians	U	- All mobile plant must only be operated by suitably licensed and trained operators i.e. CPCS cards. - Operatives to wear high visibility clothing - Banksman to be appointed to supervise works - Segregated pedestrian and vehicle access.	Plant operator, site personnel, banks man. Site supervisors.	A
24	Trapped/Crushed by:	U	- Use of permit to load form, known weights of loads - All plant access routes to be inspected for suitability of use	Plant operator, site personnel,	A

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	Plant overturned		and maintained regularly - Competent Banksman to control plant movements - Clear signals between Banksman and plant operator - Do not lift load if on uneven ground	banks man. Site supervisors.	
27	Collision with operatives and other plant. Working in restricted access areas	U	- All moving plant to be controlled by the nominated banksman - Flashing beacons on moving plant. 5mph speed limit. - Traffic management in place for works	Plant operator, site personnel, banks man. Site supervisors.	A
17, 27	Plant Movements Plant striking other plant/materials/operatives	U	- Ensure pedestrians and plant are segregated - Competent trained banksman - High visibility clothing to be worn at all times - Flashing beacons on all plant no green beacon - If necessary close off sections of footpath during operations which plant may cross - Site speed limit 5mph - Plant/equipment to have appropriate test certificates. - Clear signals between banksman and plant operator - All lifting equipment to be fit for purpose and have current certification. Excavator lifting plan to be completed - Plant movements to be coordinated to ensure priority is given to public/3rd party vehicles at all times.	Site Staff and operatives	A
15, 19	Risk of operatives being struck by a falling excavator bucket or attachment as a result of incorrect attachment or missing locking pins, resulting in death or major injury. Bucket Failure/Falling whilst digging/grading causing death, major injury Risk of serious injury to the excavator driver when changing attachments to the quick hitch mechanism. Incorrect attachment change not in accordance with	U	- CPCS Trained and Certified machine drivers/Operatives. - Machine operators must be trained and deemed competent to operate the type of quick hitch system fitted to their machine. NB: Operators must demonstrate competence by a change of bucket in the presence of Site Supervisors. - Magnor Plant Operators must be inducted by Magnor plant before being employed on a Morgan Sindall Site.	Site Management Site Management	A

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	operators manual resulting in death, major injury to persons within the operating area of the machine	- Machine operators must sign a declaration at induction to confirm that they have been trained in the use of the machine quick hitch (Quick Hitch Equipment Pre – Start Arrival Check Form) and that they have read and understood the operators' manual specific to that quick hitch. - Certificate of thorough examination or certificate of conformity for all excavators. - Manufactures installation and operation manuals for all types of Quick Hitches must be kept within the excavator and not removed from the cab. - PPM's on all plant to include quick hitch checks. - Daily check to be made on quick hitch system and / or when attachment is changed to ensure the safety pin or latch is in place and secure. NB: Operators must physically get out of the cab to check this – Mandatory Instruction) - Visual / physical inspection to be carried out of clamp connection to bucket, when the bucket has been changed and at the start of each shift - Driver to ensure pin (where applicable) has been reinserted as per manufacturer's instructions and ensure safety clip is in place - Manual quick hitch lever - to be inspected by driver after change of bucket without fail to ensure it is in its locked position.	Site Management	
	Quick Hitch failure as a result of excessive vibration.		Site Management	
	Failure of Quick Hitch or Attachments due to incorrect fitting		Operator	
	Failure of Quick Hitch or Attachments due to crowding		Operator	
			Operator	
			Operator	

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			• Buckets and other attachments shall be changed in a safe area away from operatives/third parties. • “Shake, Rattle, Roll” test of the fitted attachment, or placing the bucket flat on the ground then trying to uncrowd the bucket so that the bucket tries to disengage from the QH. Test to be carried out when a bucket is changed and at the start of every shift. • “Shake, Rattle, Roll” test to be carried out in a safe area away from traffic, operatives etc. • Bucket to be removed prior to any lifting operation by the excavator • Any excessive movement of bucket connected via a quick hitch to be reported to site supervisor immediately for investigation of working mechanism of the quick hitch. • Any visual indication of hydraulic leak near to quick hitch mechanism to be reported immediately, stop work immediately and do not commence work until authorised to do so by site supervisor. • Special care to be taken when using quick hitch systems: • Manual: This requires the winding of a screw or the use of a bar to open a spring actuated latch. • Automatic: This is operated entirely from the cab of the excavator and usually has an independent locking system which functions automatically and does not rely on hydraulic pressure to hold the latch in the closed position. The operator must ensure the locking system has completed before proceeding with work.	Operator Operator, Site Staff & Operatives. Operator, Site Staff & Operatives. Operator, Site Staff & Operatives. Operator, Site Staff & Operatives. Operator, Site Staff & Operative	
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			Ensure that the correct size of excavator has been chosen to adequately carry out the task.	Operator, Site Staff & Operatives.	
15,17,18,27	Lifting operations Load falling due to failure of lifting equipment, or incorrectly slung loads Serious injury due to crushing, possible death	U	- All lifts to be controlled by trained/competent slinger/signaller. - Lift plan to be completed by crane appointed person and plant certificates to be in place. - No personnel to stand under or near to suspended loads. - All lifting equipment to be thoroughly examined prior to use - All drivers to be competent experienced and trained to CPCS standard.	Appointed person, machine operator, slinger/signaller, Site Supervisors.	A
1,15,17,18,27	Lifting operations - Uncontrolled lifting of loads causing failure of lifting appliances or equipment - Dropping of load in an unsafe manner uncontrolled slewing causing collision with plant or operatives	U	- Trained slinger/signaller to control lifts. - Weather conditions to be monitored. - Lift plan to be produced by appointed person and briefed to all relevant personnel. - Regularly tested appliances and equipment with test certificates, to be used. - Regularly tested appliances and equipment with test certificates, to be used.	Appointed person, machine operator, slinger/signaller, Site Supervisors.	A
4, 15, 17,	Lifting operations - Off-loading / Loading of Cabins - Uncontrolled lifting of loads causing failure of lifting appliances or equipment - Dropping of load in an unsafe manner uncontrolled slewing causing collision with plant or operatives	U	- All lifts to be controlled by trained/competent slinger/signaller. - Lift plan to be completed by crane appointed person and plant certificates to be in place. - No personnel to stand under or near to suspended loads. - Delivery lifting plan & Lorry loader check form to be completed by supervisor. Supervisor to check certs of chains and HIAB before allowing the lift to commence.	Site Staff and operatives	A

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15	Unloading of materials Operatives falling off the bed of delivery vehicles whilst assisting with the unloading of materials/plant resulting in serious injury/fatality.	U	- Delivery vehicles to be fitted with integral edge protection barriers. - Under no circumstances are operatives to access the bed of a lorry unless a safe system of work is in place and agreed by the site management. - Hiab off loading form to be completed and authorised.	Site Supervisors, Operatives.	A
4,6,26	Excavation works - Poor ground conditions - Adverse weather conditions causing ground rotation - Ingress of ground water causing undermining - Crushing and /or burial of operatives at the work face. Possible ingress of plant and other operatives due to the surface effect. Usual effect of collapse is multiple fatalities. - Damage to properties due to poor ground conditions.	U	- Use of suitable temporary works as detailed by the Temporary Works Designer. - Regular inspection of temporary works and ground conditions - Arisings suitably stored away from excavations at least 45deg from depth - Excavation area to be isolated with fence and scaffold guardrails if required. - Stop works if ground conditions change and notify site staff - Pre condition surveys of existing properties. - Suitable dewatering systems where required	TW co-ordinator, engineer, site management team	A
3,4	Excavation works - Striking buried services - Possible death by electric shock/ disconnection of services to surrounding properties	U	- All excavations will be covered by a permit to excavate. - Prior to issue of the permit all service drawings are to be studied and a thorough C.A.T scan performed. - All services known and found to be marked on site. - Excavation to be carried out by hand when 500mm or less from a known service. - Trench dig to be supervised by a competent trained and experienced person - If unknown service is found, stop and report it to the site management team. - Existing services to be diverted by statutory owner.	Site management team, work supervisor, services coordinator	A

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			• Overhead warning goal posts to be present to warn of overhead power lines		
3,4	Contact with services • Injury from faulty power tools • Overhead cables • Buried Services	U	• All portable electrical equipment to have current PAT test • Use of intrinsically safe electrical equipment within confined space locations • Pat testing of all portable electrical equipment • Use of PPM scheme • Follow industry recommended standards/procedures for excavating close to buried services • Set out designated passing places beneath overhead cables • Site specific induction - warning of the over head cables • Obtain service drawings • Carry out a CAT/Genny survey using information provided • Use visual aids to assist in determination of service locations i.e. covers, track marks in rd etc. • Locations of buried services to be clearly marked by visual aids, i.e. marker posts, traffic cones, spray paint etc. • All excavations are to be carried out only when a permit to dig has been issued and signed by the appropriate persons • Excavate trial holes by hand as required to prove services • Only hand tools to be used when working within close proximity of known services • Always adopt safe methods of excavation where there is any doubt about the presence of any services • Always treat services as live unless told otherwise by your supervisor or other competent person. • Seek advice from plant owners and work in accordance with their recommendations	Site staff, operatives	A

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6,9,18	Excavation works - Existing contaminated materials in the ground - Ingestion - Skin irritation	U	- Examination of site investigation information. - Identification of materials encountered by competent person. - If materials are uncovered and not identifiable then works are to cease and seek advice from site management team. Material tests may be required to be undertaken. - COSHH assessment - Good hygiene - Tool box talks - Welfare facilities to include hot and cold running water - Issue PPE & train in use	Site management team, work supervisor, services coordinator	A
4,14,23,30	Deep excavations - Falls into excavations. - Serious injury or death due to fall from height. - Falling onto sharp or awkward objects.	U	- Solid barrier to physically prevent falling into excavations - Suitable signage to be erected - Provide substantial covering to possible fall hazard.	TW co-ordinator, engineer, site management team	A
31	Noise: - Noise level too high and affecting hearing - Disturbance to wildlife	U	- Noise to be reduced by engineering means wherever practicable, e.g. use of noise reducing blades, purchasing of silenced equipment, maintenance of equipment to manufacturers specification to avoid worsening noise, e.g. ensure rotating parts are checked for balance and replace if necessary. - Control of Noise at work regulations 2005 to apply - Where noise level is above the 1st action level, currently 80dB(A), hearing protection to be provided on request. - Where noise level is at or above the second action level, currently 85dB(A), appropriate PPE must be worn. - Operatives to be supplied and wear ear defenders to provide protection at 500-2000Hz frequency.	Site Supervision	A

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			Standard Noise Reduction (SNR) - 28-32dB - Approved to EN 352-2.		
4,6,14	Falls on same level / Falls from heights • Trip over • Fall onto sharp objects • Land on uneven surface •	U	• Good Housekeeping, ensure clean and tidy work spaces • Ensure appropriate footwear • Place waste material in the designated areas • Designated walkways to segregate operatives and materials • Suitable edge protection • Signage as necessary • Seal and close chambers when works are not being carried out at these chambers • Suitable barriers to segregate ops from sewage. • Ensure all sharp objects have “caps” placed over them • Ladders cannot be used as a working platform, and should be used as access only. Any ladder that is used for access must be tied or footed as a minimum	Site personnel	A
4, 14, 17,	Working at/ Falls from height Fall of lorry bed/Fall into trench	U	• Personnel training in working at height. • Ensure working platforms have suitable hand rails. Provision of edge protection of minimum height 950mm at all times. Provision of fall restraint systems (as last resort under hierarchy of control). • Where possible avoid work at height e.g. pre slung cabins delivered to site. Suitable edge protection in place at all times, visual inspection of hand railing periodically. <u>NO FREE STANDING GUARD RAILS ARE TO BE USED ON SITE.</u>	Site personnel	A
14,30	Use of ladders. • Fall from height resulting in fatality or major injury.	U	• Ladders are to be in good condition and display a safety tag marked with in date inspection carried out by a competent person. • Ladders are to be tied at the top and should protrude 1m above the top of the access point.	Operatives, Site Supervisor	A

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			• They are to be used for access and egress only-no working from the ladders. • No carrying materials when using ladder • If ladder is found damaged, remove it from the site • 3 points of contact when using the ladder at all times		
8,11,12	Use of abrasive wheels: Injury to user and other personnel from flying debris or incorrect use of wheel.	U	• Use of goggles (to BS2092) • Wear Mandatory PPE inclusive of Ear defenders • Tool Box Talks • Ensure all necessary guards are in place • PPM scheme • Competent person only to change blade ensuring speed match. • Do not use side of blade for any use • Ensure operatives have received abrasive wheel training • Match speed of blade to speed of power tool •	Site staff, operatives	A
7,22	Contact with flying particles: Injury from cutting/grinding/breaking operations	U	• Use dust suppression as required • Wear safety spectacles/goggles suitable for the task being carried out • Ensure the manufacturer's recommended/provided guards are present and set correctly on all tools • Ensure a clear area around operation before commencing • Heat resistant clothing • Only trained/competent operatives to use equipment • When using disc cutters always cut away from other operatives and inform anybody in the immediate area that cutting will soon commence	Site staff, operatives	A
18	Material Storage: • Improper storage/stacking of materials which could overturn/topple resulting in serious injury/fatality to nearby site personnel.	U	• A designated storage area will be fenced off using pedestrian barriers • Good housekeeping must be maintained at all times. • Visual check on lifting points to ensure integrity • Materials to be stacked on firm level ground.	Site Supervisors, Operatives	A

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			- Sheet piles are not to be stacked above 500mm in height - Timbers are to be used to separate each stack of sheet piles.		
31	Manual Handling: - Operatives suffering musco-skeletal injuries - Damaging items being lifted such as heras fence panels when putting up the perimeter fencing.	U	- Provide regular manual handling training/toolbox talks - Assess load to be lifted and use mechanical means of lifting if possible - Complete MH risk assessment if mechanical lift is not possible - Break down load to a more manageable size - More than 1 op to complete lift if load is awkward or irregular in shape - Carry out task specific manual handling risk assessment - Assess the load and decide if it needs to be lifted	Site staff, operatives	A
8	Use of small tools: - Injury due to faulty equipment - HAV's exposure limits exceeded	U	- All guards are to be in place as per manufacturers recommendations - Tool box talks on safe use of equipment etc - Remove any faulty tools/equipment etc from service immediately and inform your supervisor - PAT testing to all portable electrical Equipment - Use of correct PPE to suit equipment being used - Correct training for items being used - PPM's for each item to be completed by a competent person - Keep hands warm during colder weather - Limit "trigger" time for equipment being used - Rotate workforce - Exercise hands to increase blood flow - Suitable hand protection to be supplied and worn	Site staff, operatives	A
9	Environmental threat: - Spill resulting in pollution - Surface run off resulting in pollution	U	- COSHH assessments for all COSHH items - Use of environmentally friendly products where possible. - Dispose of all waste materials to designated skips etc.	Site staff, operatives	A

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Safety, Health and Environment Risk Assessment

			- Emergency spill kits are to be maintained at every work location or be easily accessible at all times from a centralised location - Equipment to be stored on designated drip trays/ bundied areas		
9	Contact with/exposure to hazardous substances: - Injury/poisoning/ingestion of COSHH items - Weils Disease/infection caused by contact with sewage	U	- Use alternative less harmful substances - Complete COSHH assessment and brief operatives accordingly - Training as required - Wear appropriate PPE - Only authorised personnel to use substances - Tool box talks (COSHH) - Disposal to designated COSHH skips and further disposal to licensed tip ensuring a completed waste transfer note has been completed - Do not use materials until fully aware of the associated risks - Good hygiene – wash any area that came into contact with substance thoroughly	Supervisors/ Operatives	A
9,	Refuelling of excavator & Dumpers Spillages resulting in pollution	U	- Spill response kits available at all times and around any potential pollution areas i.e. surface drains that connect to the watercourse - All refuelling operations to be undertaken at the site compound - Refuelling operations must always be manned, never left alone, or the fuel trigger jammed open. - Check hoses and valves regularly for signs of wear and re-new as and when required. - If a spill should occur please use the following STOP, CONTAIN and NOTIFY.	Site Staff and operatives	A

Document Reference	Process Parent	Revision Status	Document Owner	Date	Page
WWCDA_S1_011	SH PRO1	Rev 2	M Sellers	May 17	30 of 31

Safety, Health and Environment Risk Assessment

Method Statement required?		Yes	X	No		Method Statement number:		1W6000/4566					
Additional Risk Assessment (Tick box as required)						PPE (Tick box as required)							
Noise		COSHH		Handling		Helmet	√	Respiratory		Boots	√	High Vis	√
Asbestos		Lead		Radiation		Hearing		Eye	√	Harness		Others	
		Name				Signature				Date			
Person completing the assessment:		M. Bennett				M. Bennett				05/12/19			
Person reviewing the assessment:		A. Good				A. Good				05/12/19			
Date to be reviewed:		05/12/20											