

M7 Osberstown Interchange & R407 Sallins Bypass Scheme

Ecology

Brief of Evidence

by

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1. Introduction

- 1.1 My name is Paul Murphy and I am Director of EirEco Environmental Consultants. I hold a M.Sc. in Environmental Science, am a Chartered Environmentalist (Society for the Environment), a member of the Chartered Institute of Ecology and Environmental Management, a Member of the Institute of Fisheries Management and a Member of the Arboricultural Association. I have thirty years' experience in both temperate and tropical ecosystems specializing in nature conservation management including all aspects of ecological survey, habitat management and restoration. I have extensive experience in EIA and ecological mitigation design for numerous major infrastructural schemes including roads.
- 1.2 This is the brief of evidence for Terrestrial and Aquatic Ecology (habitats, flora and fauna) presented in Chapter 14 of the Environmental Impact Statement (EIS). I am the Principal Ecologist for the proposed M7 Osberstown Interchange and Sallins Bypass Scheme and I was the author of Chapter 14 in the EIS relating to Ecology and of the Habitats Directive Screening Report prepared for the scheme.

2. Executive Summary

2.1 Natura 2000 Sites

- As outlined in Section 14.3.2 of the EIS there is no crossing of or direct impact on any Natura 2000 site by the proposed M7 Osberstown Interchange and R407 Bypass Scheme. The proposed scheme is located approximately 7.28km from Mouds Bog SAC, and approximately 11.4km from Pollardstown Fen SAC.. A Screening Report for Appropriate Assessment was prepared for the scheme with full consideration of the conservation objectives for the various Natura 2000 sites within a 10km radius approximately of the proposed scheme The assessment was carried out in the context of best scientific knowledge and concluded that the scheme will not have any impact whatsoever on any Natura 2000 sites and no doubt arises in that regard.
- As set out in the Habitats Directive Screening Report, having taken account of the best scientific knowledge and the conservation objectives of each European Site, I have concluded and can confirm that the proposed scheme, either individually or in combination with other plans of projects such as the M7 Widening Scheme, is not likely to have any, still less any significant, effects on any European Site.

2.2 Non Natura 2000 Sites

- The main ecological impacts of the proposed scheme will arise from the construction of crossings for the Grand Canal pNHA and the River Liffey along the proposed R407 Sallins Bypass. The risks of impacting on water quality through siltation and pollution are considered temporary in nature as they are associated with the construction phase of the crossings points and works within the immediate catchment. With adherence to the specified mitigation measures detailed in Section 14.5.2 of the EIS, there will be no significant negative residual impact. The abutments and piers for the three bridge structures are set sufficiently back from the river banks to avoid any direct impacts on the riparian zone and will not interfere with the on-going ecological functioning and connectivity of these linear habitats.
- The risks of impacting on water quality through road-runoff and accidental spillages resulting from traffic accidents during the operation phase of the proposed scheme have been mitigated though the design of the road drainage and associated attenuation, spill containment and run-off treatment facilities.

3. Impact Assessment Methodology

- 3.1 The impact assessment methodology is outlined in Section 14.2 of the EIS. This involved desk reviews of existing data, survey and mapping of habitats along the entire scheme, survey of all watercourses and aquatic habitats in the vicinity of the, a detailed mammal survey and targeted surveys for various protected species including lamprey, crayfish and barn owl. *Aardwolf Wildlife Surveys* undertook a study of bat fauna within the vicinity of the proposed scheme.

4. Existing Environment

- 4.1 The existing environment is described in details in Section 14.3 (P 14-5 to 14-12) of the EIS. However, for the purposes of dealing with the submission from the Department of Arts Heritage and the Gaeltacht (DAHG), it is important to state at the outset that, as set out at Section 14.3.2.1 of the EIS, there is no crossing of or direct impact on any Natura 2000 site by the proposed M7 Osberstown Interchange and R407 Bypass Scheme.

The proposed scheme is located approximately 7.28km from Mouds Bog SAC, and approximately 11.4km from Pollardstown Fen SAC both of which are classified as groundwater dependant habitats. Some confusion may have been caused by these distances being incorrect in the Habitats Directive Screening Report which have been corrected in the Errata presented to the hearing.

Further the matters raised by the DAHG in their submission to An Bord Pleanála in relation to potential impacts on these SAC's are addressed fully in a specific technical assessment (*M7: Hydrogeological Impact Assessment of Cut Sections*) which was furnished to the DAHG and is appended to the brief of evidence of the Hydrogeologist and with which I fully agree. This technical assessment provides confirmation that the proposed scheme will not have any impact on those European Sites. The maximum radius of influence from cuttings on the proposed scheme is 93m whereas the Curragh aquifer is 2.41km from the closest location requiring dewatering on the scheme. Using even the most conservative estimates, it is clear that with the proposed development there will be no dewatering at the Curragh aquifer, Mouds Bog or Pollardstown Fen and therefore it is certain from an ecological perspective that the proposed development will have no impact whatsoever on the Curragh aquifer, Mouds Bog or Pollardstown Fen.

Further the Habitats Directive Screening report was prepared with full consideration of the conservation objectives for the various Natura 2000 sites within a radius of approximately 10km of the proposed scheme (while Pollardstown Fen SAC is over 10kms away from the scheme it was considered in the assessment carried out). The assessment was also carried out in the context of best scientific knowledge and concluded that there is no conceivable doubt that the scheme will have any impact whatsoever on any Natura 2000 sites.

- 4.2 As set out in Section 14.2.3 of the EIS, *Aardwolf Wildlife Surveys* carried out a study of bat fauna within the area of the proposed M7 Osberstown Interchange and R407 Sallins Bypass road to determine the suitability of the habitats for roosting, commuting and feeding purposes by bats. These surveys found that four species of bat were recorded during surveys undertaken in the vicinity of the proposed scheme in October 2013, though no evidence of roosting bats was observed at any of the structures on or immediately adjacent to the planned route.
- 4.3 In response to the submission by the DAHG, a dedicated survey for barn owls was undertaken in spring 2014 to assess suitable cavities in trees and old buildings for nest sites in the vicinity of the scheme. No evidence of nests sites or owl activity was recorded and there are no records of Barn Owl from the vicinity of the proposed scheme.

5 Impact Assessment

- 5.1 The Impact Assessment on the Ecological Environments is set out in Section 14.4 of the EIS. The Grand Canal, a proposed Natural Heritage Area will be crossed by the proposed scheme at Ch. 1+555 along with a spur referred to as the 'dead canal' on the Sallins Link Road at Ch. 0+330. The main channel of the Grand Canal will be crossed by a clear span structure encompassing both the tow path and local road on either side of the canal as shown in Figure 4.7 of the EIS. Overall however, the structure will not interfere with this proposed pNHA and the impact on the pNHA at this location is rated as slight.
- 5.2 The 'dead canal' spur being crossed by the Sallins Link Road at Ch. 0+330 will be crossed by a portal frame culvert which will allow for the unimpeded movement of otter and aquatic fauna. Overall the impact on the pNHA at this location is rated as moderate.
- 5.3 There will be no direct or indirect impacts on any other designated areas for nature conservation as a result of the construction or operation of the proposed road.
- 5.4 The crossings of the River Liffey at Ch. 2+000 and Ch. 3+050 will be by bridge structures (as detailed in Figure 4.8 and Figure 4.9 of the EIS respectively) which will have clear spans across the river channel, maintaining both river banks intact and providing unobstructed access for anglers. There will also be a requirement for a temporary crossing to facilitate construction. The main impacts on the River Liffey will be temporary in nature associated with the construction phase of both crossings points and works within the immediate catchment. The overall impact of the proposed crossings are rated as moderate as the character of the environment at both sections of the river will be permanently altered.
- 5.5 Elsewhere on the proposed scheme, the principal impacts will be on treelines and hedgerows which will be dissected by the proposed route resulting in a loss of this habitat resource and severance of ecological corridors. The impacts on these features is rated as slight, though over time with the maturation of landscaping in combination with faunal passage facilities associated with the development, the impact may reduce to imperceptible.
- 5.6 The main risk to mammals from the proposed scheme will be as a result of increased risk of mortality during the operation phase. There is no evidence of any badger setts or other mammal refugia occurring on the line of the proposed scheme. Subject to the provision of adequate mammal passage facilities and associated fencing, the impact on mammals from the scheme should be imperceptible to slight.
- 5.7 The main impacts on bats will arise through the severance and loss of hedgerows and treelines along the proposed route corridor. Large deciduous trees within the footprint of the scheme may support bat roosts and their loss will result in a slight negative impacts. The two crossings of the River Liffey and the Grand Canal are unlikely to interfere with the movement of bats due to the height and span of the structures which will accommodate movement.

6 Mitigation Measures

- 6.1 The Mitigation Measures for the Ecological Environments are set out in Section 14.5 of the EIS. The crossing of Grand Canal pNHA at Ch. 1+555 will be by a clear span structure encompassing the canal and both the tow path and adjacent local road, which is designed to allow for

uninterrupted continuity of the linear habitat and associated fauna. Measures to avoid impacts on water quality are detailed in Section 14.5.2 of the EIS.

- 6.2 The crossings of the River Liffey at Ch. 2+000 and Ch. 3+050 have been designed to provide a clear span across the river channel at both locations maintaining both river banks intact in order to avoid any instream disturbance and to maintain the riparian zone of the channels. To minimise disturbance during construction the work zones in the vicinity of the River Liffey will be defined at the outset of construction using rigid fencing. Within the works site, earth bunds will be constructed to contain surface water run-off and channel it to silt traps before discharge. Measures of pollution control for road run-off to the River Liffey during the operation phase of the proposed scheme include provision of vegetated treatment systems which will function as attenuation, treatment systems and containment to accommodate accidental spillage.
- 6.3 Measures to avoid impacts on water quality during construction as detailed in sections 14.5.2 of the EIS will be incorporated in their entirety into the construction contract documentation including the Sediment and Erosion Control Plan for the scheme which was discussed by Eileen McCarthy in her brief of evidence.
- 6.4 Prior to site clearance works in the vicinity of hedgerows, treelines and other locations where trees are present, all woody vegetation to be retained, will be afforded protection in accordance with BS 5837:2012 (*Trees in relation to design, demolition and construction – Recommendations*) under the guidance of a qualified arborist.
- 6.5 For terrestrial habitats, the principal mitigation will be the minimisation of impacts during the construction phase coupled with the design of the landscaping associated with the proposed scheme in accordance with *A Guide to Landscape Treatments for National Road Schemes in Ireland* (NRA, 2006).
- 6.6 Mitigation requirements for mammals primarily entail the provision of safe passage along all watercourses crossed by the proposed scheme for otter and the provision of underpasses and guide fencing at prescribed locations for general mammal movement across the scheme.
- 6.7 To avoid impacts on bats, mature trees which are to be removed will be felled in the period late August to early November. Ivy-covered trees, once felled, will be left intact on-site for 24 hours prior to disposal to allow any bats beneath the foliage to escape overnight. Bat boxes will be erected to provide alternative roost sites. Where lighting is required along the scheme directional lighting will be used to prevent overspill. Severed linear habitat features will be reconnected using semi-mature trees under-planted with hedgerow species to re-establish flight corridors. The success of the mitigation measures for bats will be monitored for a period of three years after construction and appropriate measures taken to enhance these if and where required.
- 6.8 To avoid impacting on breeding birds, no vegetation clearance will be carried out in relation to the proposed scheme within the period March 1st to August 31st in accordance with the Wildlife (Amendment) Act 2000.

7 Residual Impacts

- 7.1 The main ecological impacts of the proposed scheme are associated with the construction phase of the crossings points for the Grand Canal pNHA and the River Liffey along the proposed R407 Sallins Bypass. The risks are considered temporary in nature and, with adherence to the specified mitigation measures detailed in Section 14.5.2 of the EIS, there will be no significant

negative residual impact. The abutments and piers for the three bridge structures are set sufficiently back from the river banks to avoid any direct impacts on the riparian zone and will not interfere with the ongoing ecological functioning and connectivity of these linear habitats.

- 7.2 The operation phase of the proposed scheme presents a risk of impacting on water quality through road-runoff and accidental spillages resulting from traffic accidents, though the design of the road drainage and associated attenuation spill containment and run-off treatment will provide adequate protection against these risks. As a result the operation of the proposed scheme will not result in any residual impact on water quality.
- 7.3 Elsewhere on the proposed scheme, there will be a loss of habitats associated with the construction and operation of the proposed scheme, with the principal ecological receptors of concern being the treelines and hedgerows that will be dissected by the proposed route with resultant severance of ecological corridors. Over time landscaping for the proposed scheme will compensate for the loss of this habitat and to some extent provide ecological continuity which will be further facilitated through the provision of mammal underpasses.

8 Response to Submissions

8.1 Response to Dept. of Arts, Heritage and the Gaeltacht submission.

8.2 Natura 2000 Sites

A concern was raised regarding the Habitats Directive Screening Report conclusion that there are no direct hydrological connections between the proposed Scheme and Pollardstown Fen and Mouds Bog. As set out at Section 4.1 above, the matters raised by the DAHG in their submission to An Bord Pleanála in relation to potential impacts on these SAC's was addressed fully in a specific technical assessment entitled M7: *Hydrogeological Impact Assessment of Cut Sections* which has been furnished to the DAHG and which confirms the conclusion in the Habitats Directive Screening Report that there is no direct or indirect hydrological connectivity between the Scheme and Pollardstown Fen SAC or Moulds Bog SAC and that, applying best scientific knowledge, the scheme will not have any impact whatsoever on any Natura 2000 sites and no doubt arises in that regard.

In relation to the conservation objectives for Pollardstown Fen as discussed in the DAHG's submission, as set out earlier in this brief, the Conservation Objectives were taken into account and considered in the preparation of the Habitats Directive Screening Report and in my assessment of any likely significant impacts on Pollardstown Fen SAC. For completeness the conservation objectives of each of the Natura 2000 site referred to in the Habitats Directive Screening Report are set out in Appendix 1 to this brief.

I have also taken into account the content of the DAHG submission in relation to conservation objectives. There are no site specific conservation objectives yet developed for Pollardstown Fen SAC and Moulds Bog SAC, only a generic conservation objective "*To maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected*". I can confirm that I have also considered and assessed any likely significant impacts on the various Natura 2000 sites within a radius of approximately 10km of the proposed scheme (Note: while Pollardstown Fen SAC is over 10kms away from the scheme it was considered in this assessment) in light of site-specific conservation objectives developed for sites with similar qualifying interest. The pertinent attributes and targets for these sites (Galway Bay complex CSAC (site code 000268) and the River Barrow and River Nore SAC (site code 002162) are listed in Appendix 2 of this brief of evidence.

I can confirm that I have arrived at the same conclusion as in the Habitats Directive Screening Report that in light of these conservation objectives and applying best scientific knowledge, the scheme will not have any impact whatsoever on any Natura 2000 sites and no doubt arises in that regard.

8.3 Bats

The DAHG is correct that the Bat Survey results have not been included in the EIS. This is because this is not data that is required to assess the main environmental impacts of the proposed scheme. For completeness, the bat survey report prepared by Conor Kelleher of Aardwolf Wildlife Surveys dated 16th October 2013 which is referred to at Section 14.2.3 Page 14-3 of Volume 2 of the EIS has been submitted to the DAHG under cover of letter dated 21 May 2014. The bat survey was carried within the area of the proposed M7 Osberstown Interchange and R407 Sallins Bypass road to determine the suitability of the habitats for roosting, commuting and feeding purposes by bats. Four species of bat were recorded during surveys though no evidence of roosting bats was observed at any of the structures on or immediately adjacent to the

planned route. These surveys informed the mitigation measures relative to Bats that are set out at Section 14.5.3 Page 14-23 of Volume 2 of the EIS.

8.4 Otters

The DAHG have raised concerns regarding the position of the bridge foundations relative to the river bank at the River Liffey crossings in relation to the potential impacts on the riparian zone and otter habitat. As detailed in Figures 4.8 and 4.9 Volume 3 of the EIS, both crossings of the Liffey are multi-span structures providing a clear span over the river channel. Structure 1 is a two-span structure with abutments located at a distance of 58.7m and 12.5m respectively from the river bank, and a single pier located 13.5m from the river bank. Structure 2 is a three-span structure with both abutments located at a distance of 37m from the river edge and intermediate piers at a minimum distance of 5 meters from the river. Such setbacks enable both banks to be retained intact and enable the passage of otters between the river bank and the abutments.

The bridge foundations are situated at such a distance as to have no likely significant effect on the riparian zone and otter habitat. Therefore, there is no reason whatsoever for the contractor to be anywhere near the riverbank when constructing these structures, and this area will be fenced off 3m from the river bank during construction to restrict access.

As Project Ecologist I am satisfied that these matters have been fully assessed in the EIS and I am fully satisfied that the movement of otter will be unimpeded and unaffected by the scheme and that there will be no likely significant effects on the riparian zone and otter habitat.

8.5 Construction Management Plan/Emergency Operating Plan/Mitigation Measures

The Department has requested that the mitigation measures as detailed in the EIS and the AA Screening Report (Habitats Directive Screening Report) should form part of the Construction Management Plan which, as outlined by the Department, is prepared by the successful contractor at construction phase. The Construction Management Plan will set out the contractor's construction strategy, staging and phasing of the works, all of which are necessary to fully comply with the Environmental Operating Plan.

Ms. McCarthy has set out in her brief of evidence that the Environmental Operating Plan will contain the following items as a minimum:

- Final schedule of commitments;
- Conditions of planning;
- Incident Response Plan;
- Construction and Demolition Waste Management Plan, and
- Sediment and Erosion Control Plan.

The minimum standards as set out in these plans were extracted from various locations throughout the EIS and so were contained in the EIS, but for completeness have been distilled into a single document/plan. Any additional commitments and/or conditioned mitigation measures imposed by An Bord Pleanála will be incorporated into the final schedule of commitments and will be reflected in the Incident Response Plan, Construction and Demolition Waste Management Plan and the Sediment and Erosion Control Plan as necessary when prepared in the final instance. 8.6 Invasive Species

The DAHG requires specific measures to be included within the Construction Management Plan to deal with the control and management of invasive species such as Himalayan Balsam. The

adherence to the NRA Guidance for Invasive Species and any updated approaches prescribed by Invasive Species Ireland has already been presented as a stated mitigation within Section 14.5.2 of the EIS and, as with all proposed mitigation measures will be implemented, and same has also been incorporated into the schedule of commitments which is incorporated within the outline Environmental Operating Plan.

8.7 Licences/Derogations

The DAHG has noted that all required licences or derogations should be in place for impacts on protected species or their resting or breeding places. Applications for licences or derogations have already been submitted to the Department.

8.8 Barn Owls

The DAHG recommend that specific surveys be undertaken for Barn Owl with appropriate mitigation measures put in place as necessary. A specific survey for this species was undertaken in spring 2014 to assess suitable cavities in trees and old buildings for nest sites in the vicinity of the scheme. The results of those surveys carried out by me shows that there are no evidence of Barn Owl or nests sites in the vicinity of the proposed scheme.

8.9 Response to Inland Fisheries Ireland (IFI) submission.

The minimum standards to be included in the Construction and Demolition Waste Management Plan and Sediment and Erosion Control Plan have been prepared from what is set out in the EIS and have been referred to in the lead brief of evidence. Further all commitments and mitigations measures as detailed in the EIS, Habitats Directive Screening Report and as additionally committed to during the Oral Hearing Process will be included in the final version of the schedule of commitments/mitigation measures, a draft of which was handed into the hearing. It is confirmed that all instream works will be undertaken outside of the Fisheries Closed Season between May and September as requested by IFI and as has been detailed at Section 14.5.2 of Volume 2 of the EIS and also as set out in this section of the EIS method statements will be furnished to the IFI for approval prior to commencement of construction. It is confirmed that all detailed design for watercourses crossings and other structures on salmonid channel will be subject to the agreement of IFI.

8.10 Response to Mr Desmond Ward and Mr Pat O'Brien.

In Item i of their submissions, both parties maintain that the M7 Osberstown Interchange and Sallins Bypass Scheme and the M7 Widening Scheme should be addressed together in a single EIS and Appropriate Assessment as do otherwise constitutes project splitting. While this is a submission that touches on legal matters, the Habitats Directive Screening Report undertaken for this schemes considered and assessed the cumulative and in-combination effect of both schemes.

In Item ii of their submissions, both parties mistakenly maintain that the Screening Report prepared by EirEco "concludes that Appropriate Assessment is not necessary". The Screening Report forms the first stage of the Appropriate Assessment process and concluded that there no direct or indirect impact on any Natura 2000 site either alone or in combination with other plans or projects. It then stated that there was no requirement to proceed to Stage 2: Natura Impact Statement.

9 Conclusions

9.1 Natura 2000 Sites

As set out in the Habitats Directive Screening Report and taking account of the best scientific knowledge and the conservation objectives of each European Site, the proposed scheme either individually or in combination with other plans of projects such as the M7 Widening Scheme, is not likely to have any significant effects on any European Site. Indeed, it will not have any effects on any European Site.

9.2 Non Natura 2000 Sites

The main ecological impacts of the proposed scheme will arise from the construction of crossings for the Grand Canal pNHA and the River Liffey along the proposed R407 Sallins Bypass. The risks are considered temporary in nature as they are associated with the construction phase of the crossings points and are readily mitigated for by the proposed measures within Section 14.5.2 of the EIS.

The risks of impacting on water quality through road-runoff and accidental spillages resulting from traffic accidents during the operation phase of the proposed scheme have been mitigated through the design of the road drainage and associated attenuation, spill containment and run-off treatment facilities.

Appendix 1.
Conservation Objectives for Natura 2000 Sites within approximately 10km of the Scheme

Site code	Site name	Approx. Distance km	Qualifying interests (Those with an asterisk are Priority habitats)	Conservation Objectives
000391	Ballynafagh Bog SAC	7	* Active raised bogs Degraded raised bogs still capable of natural regeneration Depressions on peat substrates of the Rhynchosporion	Objective: To maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected.
001387	Ballynafagh Lake SAC	8	Vertigo moulinsiana Marsh frillitary Transition mires and quaking bogs Alkaline fens	Objective: To maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected.
002331	Mouds Bog SAC	7.28	* Active raised bogs Degraded raised bogs still capable of natural regeneration Depressions on peat substrates of the Rhynchosporion	Objective: To maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected.
000396	Pollardstown Fen SAC	11.4	Vertigo geyeri Vertigo angustior Vertigo moulinsiana Calcareous fens with Cladium mariscus and species of the Caricion davallianae Petrifying springs with tufa formation (Cratoneurion) Alkaline fens	Objective: To maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected.
004063	Poulaphuca Reservoir SPA	10	Greylag Goose Lesser Black-backed Gull	Objective: To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA
000397	Red Bog SAC	10	Natural eutrophic lakes with Magnopotamion or Hydrocharition-type vegetation Active raised bogs Transition mires and quaking bogs	Objective: To maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected.
001398	Rye Water Valley / Carton SAC	10	Vertigo angustior Vertigo moulinsiana Petrifying springs with tufa formation (Cratoneurion)	Objective: To maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected.

**Appendix 2.
Conservation Objectives for sample Natura 2000 Sites with ground water dependant habitats**

Site code	Site name	Qualifying interests	Attribute	Measure	Target	Notes
000268	Galway Bay Complex SAC (Conservation objectives Ver. 1 16/4/13)	Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davallianae</i>	Hydrological regime	Flow rates, metres	Appropriate natural hydrological regime necessary to support the natural structure and functioning of the habitat	Maintenance of groundwater, surface water flows and water table levels within natural ranges is essential for this wetland habitat
			Water chemistry nutrients	Water quality: measures	Appropriate water quality to support the natural structure and functioning of the habitat	Fens receive natural levels of nutrients (e.g. iron, magnesium and calcium) from water sources. However, they are generally poor in nitrogen and phosphorus with the latter tending to be the limiting nutrient
		Alkaline fens	Hydrological regime	Flow rates, metres	Appropriate natural hydrological regime necessary to support the natural structure and functioning of the habitat	Maintenance of groundwater, surface water flows and water table levels within natural ranges is essential for this wetland habitat
			Water quality Nutrients	Water chemistry measures	Appropriate water quality to support the natural structure and functioning of the habitat	Fens receive natural levels of nutrients (e.g. iron, magnesium and calcium) from water sources. However, they are generally poor in nitrogen and phosphorus with the latter tending to be the limiting nutrient
002162	River Barrow and River Nore SAC (Conservation objectives Ver. 1 19/7/11)	* Petrifying springs with tufa formation (<i>Cratoneurion</i>)	Hydrological regime: height of water table; water flow	Metres; metres per second	Maintain appropriate hydrological regimes	Current hydrological regimes are unknown. Petrifying springs rely on permanent irrigation, usually from upwelling groundwater sources or seepage sources
			Water quality	Water chemistry measures	Maintain oligotrophic and calcareous conditions	Water chemistry is currently unknown. Water supply to petrifying springs is characteristically oligotrophic and calcareous