

Proposed Development at Knockharley Landfill (ABP Planning Ref. PL17.303211

Response to Request for Further Information – Query No. 4 Part 2

Response to FERS Ltd. Peer Review Report on the Appropriate Assessment Screening and Natura Impact Statement

CREATED FOR:

Knockharley Landfill Ltd.



CREATED:

October 2019

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1 RESPONSE TO FERS REPORT ON STAGE ONE SCREENING FOR APPROPRIATE ASSESSMENT

Knockharley Landfill Ltd. submitted an application for a proposed strategic infrastructure development at Knockharley Landfill in December 2018. This application for permission was accompanied by an Appropriate Screening Assessment and a Natura Impact Statement. In a request for further information dated 16th May 2019, at paragraph 3, An Bord Pleanála requested the applicant to submit the following supplementary information in respect of Biodiversity:

The applicant is requested to review and consider in full the issues raised in the Peer Review Report commissioned by Meath County Council on the biodiversity chapter of the EIAR, the Appropriate Assessment Screening Report and the Natura Impact Statement. The report identifies perceived deficiencies and issues which the applicant is requested to address. The applicant should consider the requirement for additional surveys for species of conservation interest and the availability of suitable habitats for such species. The response should ensure that adequate and up to date information is available to enable the Board to fully assess the ecological impacts of the proposed development and to carry out an Appropriate Assessment for the purposes of Article 6(3) of the Habitats Directive.

This document has been prepared in response to RFI No. 4 Part 2, where Part 1 is the biodiversity chapter and Part 2 is the Appropriate Assessment Screening Report and the Natura Impact Statement.

Meath County Council commissioned FERS Ltd. to prepare a peer review on the Appropriate Assessment Screening Report and the Natura Impact Statement. This report is referenced in this response document as the FERS report.

It is noted, as set out below, a number of statements and observations within the FERS report are misrepresentative and inaccurate.

The purpose of this response is to clarify and reaffirm the appropriateness, findings and conclusions of the Appropriate Assessment Screening Report and Natura Impact Statement and to clarify the inaccuracies in the FERS report.

This report addresses each comment raised in the FERS report. Section numbers from the FERS report are dealt with in sequence, with specific text from the FERS report in italics. Direct quotes from the Stage One Screening for Appropriate Assessment and Natura Impact Statement have a grey background.

1.1 Stage One Screening for Appropriate Assessment

Section 1.1 addresses the Stage One Screening for Appropriate Assessment for the Proposed Strategic Infrastructural Development at Knockharley Landfill (FT, 2018).

1.1.1 Peer Review Report (FERS, 2019) Assertion Section 6.2.1

Section 6.2.1: The failure to take into account leachate and surface water treatment into account in the AA Screening assessment comprises significant lacunae.

Response

With respect to on-site leachate and surface water treatment, the Stage One Screening for Appropriate Assessment is very clear, the existing facility has been designed and constructed and the future elements have been designed and will be constructed to the standard set out in Directive 1999/31/EC on the landfill of waste¹. This includes amongst others, the requirement for a liner system ($K \leq 1.0 \times 10^{-9}$ m/s thickness ≥ 1 and an artificial sealing liner with a drainage layer ≥ 0.5 m and to collect contaminated water from the cells and leachate and to treat contaminated water and leachate collected from the landfill to the appropriate standard required for their discharge.

¹ In 2014, the European Commission adopted a legislative proposal to review waste related targets in the Directive.

The EPA is responsible for ensuring that landfills in Ireland are developed, managed, monitored and subjected to aftercare procedures in compliance with the Waste Management Act, 1996 as amended and the requirements of the EU Directive on the landfill of waste. The EPA will not grant a licence, nor will it approve the acceptance of waste at a constructed facility, until it is satisfied that all criteria have been met as per the requirements of the EU Directive on the landfill of waste and the Waste Management Act, 1996 as amended. The design of the facility is therefore in accordance with these requirements and was described in Section 1.3.5 of Appendix 2 of the Stage One Screening for Appropriate Assessment as follows and in Section 1.7 of the same Appendix which is too long to repeat here but is in summary a series of tanks and lagoons to hold and treat leachate if required, to reduce the pH of leachate generated from incinerator bottom ash (IBA) and to reduce the biological loading, of municipal solid waste (MSW) leachate prior to tankering off-site for treatment at an authorised waste water treatment plant.

Future cell construction within the currently permitted development will continue to be constructed in the same manner as cells currently constructed i.e. using a 1.0 m composite barrier system comprising an underliner drainage system to control groundwater, 1.0 m clay (permeability of 1×10^{-9} m/s) or equivalent, overlain with a 2.0 mm thick HDPE drainage liner.

A 500 mm drainage stone layer will be placed above the HDPE barrier within which collection pipework will facilitate leachate removal. Side slopes will be overlain with a protection geocomposite or similar, to protect the liner during waste placement.

Cell depth below existing ground level will continue as per the existing planning permission and IED Licence. Overburden will continue to be used for the engineered clay barrier and for screening bunds, as discussed in more detail in Section 2.14.3.2, Section 2.14.3.6, and in Chapter 11 Soils, Geology and Hydrogeology of Volume 2 of the EIAR.

During waste placement, horizontal and vertical gas collection pipework will be installed to facilitate extraction, under negative pressure, of landfill gas, as may be required in cells designated for the placement of non-stabilised residual waste. During cell construction, the perimeter gas collection pipework will be extended from the in-situ above ground system on-site.

Leachate from cells is currently pumped from the base of cells via a rising main to a below ground floating cover leachate lagoon onsite, prior to tankering off-site to a wastewater treatment plant. Future leachate treatment is described in more detail in Section 1.7. Future cell construction will include similar leachate extraction infrastructure.

Therefore as leachate is not generated prior to waste acceptance, there is no potential for direct or indirect effects from leachate during the construction phase.

There is potential for effects on water quality in the extremely unlikely event of the leachate management system was not operated in accordance with the licence, or if it was not maintained, e.g. failure of all pumps over a prolonged period where landfilling continued and rainfall kept percolating the active area.

Surface water collection and management during the operational phase is summarised in Section 4 and described in detail in Appendix 4, Section 2.8 of the Stage One Screening for Appropriate Assessment Report. Essentially the management of surface water is to minimise the generation of leachate by preventing infiltration into waste, to separate surface water from leachate or contaminated surface water and to control the rate of discharge to the receiving water. Contaminated surface water will be directed to the leachate management system. As described in the sections referenced above in this paragraph, surface water is managed on site via separate collection, attenuation and discharge via a wetland to Knockharley Stream. The attenuation pond also provides sediment control and this together with the polishing effect of the wetland is the only form of proposed surface water treatment during the operational and aftercare phase on or off site. As described in Section 1.14.1 of Appendix 4 of the Stage One Screening for Appropriate Assessment Report, it is proposed to construct the northern surface water management system in year 1. This will facilitate the management of surface water generated during the following construction phases. The EPA will not approve waste acceptance until the surface water drainage infrastructure is commissioned to its approval. As per Section 1.13.3. of Appendix 4 of the Stage One Screening for Appropriate Assessment Report, surface water during construction will be managed as set out in the Construction Environmental Management Plan (CEMP), where similar to the operational phase the only surface water treatment is sediment control in stilling ponds.

Contrary to the FERS report, there was not a failure on the part of the applicant to take account of leachate and surface water treatment in the AA Screening Assessment.

As is evident from reading the documentation submitted to the Board by FT on behalf of the applicant, leachate and surface water treatment was taken into account.

As set out below, Table 5.4 of the Stage One Screening for Appropriate Assessment Report provides details with regard to leachate and surface water. Indeed, leachate and surface water was specifically referenced as one of the individual elements of the proposed development that *could potentially* give rise to significant effects on the Natura 2000 sites are:

- During construction and operation phases: Potential release of sediment, nutrients (from felling) and pollutants (fuel, sanitary waste) via surface water runoff into the Knockharley Stream which feeds into the River Nanny which is designated as River Nanny Estuary and Shore SPA (site code 004158)
- During operation decommissioning phases: Potential discharge of collected contaminated surface water (IBA dust and leachate spills) runoff into the Knockharley Stream which feeds into the River Nanny which is designated as River Nanny Estuary and Shore SPA (site code 004158)

Additional references to leachate within Table 5.4 include:

.....During the operation phase, prior to the implementation of mitigation measures there is potential for runoff contaminated with leachate spills and IBA dust, collected by water attenuation lagoons to be released into the Knockharley Stream.....

.....There is the potential for habitat alteration in the absence of mitigation measures due to a negative change in water quality from the ingress of sediment and pollutants (IBA dust and leachate spills) within the River Nanny Estuary and Shore SPA downstream of the proposed site. A potential significant effect on the water quality of the SPA could have an indirect effect on the special conservation interests of the SPA; causing a decrease in their food supply. While there is a distance of 22km (in-stream distance) between the proposed development and the SPA and the dilution factor, a significant effect on special conservation interests cannot be completely ruled out in the absence of mitigation measures.....

With regard to surface water treatment Section 4 includes reference to the following elements:

- Construction of surface management infrastructure, with discharge to the adjacent Knockharley Stream to the northern end of the landfill footprint and the proposed IBA cell development. Key elements will comprise:
 - holding pond for surface water runoff
 - wetland
 - flood culvert to provide equivalent 1:1000-year flood plain storage
 - permitted stream diversion around permitted development

The effects of contaminated surface water were assessed as part of the Stage One Screening, as noted above in Table 5.4. In Section 5.4.3.1 and Section 5.4.3.2, potential adverse effects were identified including the following:

However, the SPAs receiving habitat could potentially be adversely impacted indirectly if pollutants (during both the construction and operation phase) entered the watercourse downstream of the proposed development. This could result in the reduction of food source for birds (special conservation interests) which would result in the displacement in bird species. Based on the precautionary principle appropriate mitigation measures during the construction phase of the development would further reduce any potential risk. However, for the purposes of this Stage One Screening Report, no consideration has been given to such mitigation measures.

There is the potential, in the absence of mitigation measures, for contaminated run-off to be collected via the proposed surface water management system which discharges into the Knockharley Stream. There is potential for an adverse impact on water quality due to the previously mentioned hydrological link between the proposed development and the *River Nanny Estuary and Shore SPA (Site Code: 004158)* which could alter *Wetland and Waterbirds [A999]*. While unlikely it cannot be excluded out without the implementation of mitigation measures. For the purposes of this Stage One Screening Report, no consideration has been given to such mitigation measures.

There is the potential, in the absence of mitigation measures, for contaminated run-off to be collected via the proposed surface water management system which discharges into the Knockharley Stream. There is potential for an adverse impact on water quality due to the previously mentioned hydrological link between the proposed development and the *River Nanny Estuary and Shore SPA (Site Code: 004158)* which could result in the displacement of bird species due to a lack of food. While unlikely it cannot be ruled out without the implementation of mitigation measures. For the purposes of this Stage One Screening Report, no consideration has been given to such mitigation measures.

1.1.2 Peer Review Report (FERS, 2019) Assertion Section 6.2.1.

Section 6.2.1: The potential impacts of the tankered leachate at their destination is not addressed sufficiently within the project description or the Appropriate Assessment screening.

Response

Section 1.7.2.5 of Appendix 2 of the Stage One Screening for Appropriate Assessment Report states that there will be up to 14. no daily traffic movements of leachate in either 25 tonne or 15 tonne rigid tankers. Leachate is transported by a waste contractor with a waste collection permit that authorises transport of leachate. The leachate is and will be transported by waste collection permit holders to fully consented waste water treatment plants (WWTPs). Leachate is currently transported to Ringsend WWTP (D0034-01) or Enva WWTP (W0192-03) in Dublin, or to Navan WWTP (D0059-01) in Meath or Drogheda WWTP (D0041-01) in Louth. The 3 no. WWTPs operated by Irish Water have an EPA licence to discharge. The Enva facility in Dublin has an IED licence to operate. It is anticipated that leachate from Knockharley Landfill will continue to be transported to one or more of these 4 no. facilities. The assessment of activities at each WWTP has been completed by WWTP operators which include Irish Water and the private sector under a waste licence from the EPA in their applications to the EPA for Waste Water Discharge Authorisations. Leachate is discharged to the WWTP inlet in accordance with the effluent acceptance procedures at each WWTP. Leachate from all landfills in Ireland is tankered or pumped to WWTPs usually for full or final treatment. Every WWTP is assessed by the EPA under the Habitats Directive, as to whether the discharge of the WWTP is likely to have significant effects on Natura 2000 sites. Therefore, the impact of tankered leachate is assessed at its destination.

1.1.3 FERS Report Assertion Section 6.2.2.3

Section 6.2.2.3 The Appropriate Assessment Screening report has failed to identify the qualifying interests of the Boyne Coast and Estuary SAC.

Response

There was no necessity for the Stage One Screening for Appropriate Assessment Report to identify the qualifying interests of the Boyne Coast and Estuary candidate Special Area of Conservation [cSAC] because not only is that European site more than 15 km from the proposed development but, significantly, there is no ecological linkage-between the site of the proposed development and this European site. Of course, all of this is stated in the Stage One Screening for Appropriate Assessment Report within which it is correctly concluded that there is no potential for direct or indirect impacts to the Boyne Coast and Estuary cSAC based on the lack of ecological linkage.

Section 5.1 of the Stage One Screening for Appropriate Assessment Report states: The 15km buffer was initially evaluated to determine the locations and connectivity to the proposed development site. The search area was then increased to encompass sites which were ecologically connected to the proposed development.

Section 5.2 of the Stage One Screening for Appropriate Assessment Report states: Extending further than the 15km, the Boyne Coast and Estuary cSAC is located 18.7 km from the site and is not ecologically connected and so there is no potential for direct or indirect impacts to this site.

For the avoidance of any doubt, the qualifying interests of the Boyne Coast and Estuary cSAC are appended to this document (Appendix 1).

However, it is reiterated that, in the circumstances where there is no ecological linkage or pathway between the site of the proposed development at Knockharley and the European site, there is no potential for direct or indirect impacts to the Boyne Coast and Estuary cSAC or its qualifying interests.

1.1.4 Peer Review Report (FERS, 2019) Assertion Section 6.2.2.4

Section 6.2.2.4: *The Appropriate Assessment screening report has not provided any information regarding the Conservation Objectives of:*

- The River Boyne and River Blackwater SAC
- The River Boyne and River Blackwater SPA
- The Boyne Coast and Estuary SAC or
- The Boyne Estuary SPA

Response

Table 5.1 Section of the Stage One Screening for Appropriate Assessment Report includes the 3 no. European sites which are within 15 km of the proposed development, listed as:

- The River Boyne and River Blackwater SAC
- The River Boyne and River Blackwater SPA
- The Boyne Estuary SPA

The table states the features of interest, a summary of the site, the distance from the proposed development and the potential for impacts. In each instance the table states that there is no link to the sites.

And;

Section 5.1 of the Stage One Screening for Appropriate Assessment Report states: The 15km buffer was initially evaluated to determine the locations and connectivity to the proposed development site. The search area was then increased to encompass sites which were ecologically connected to the proposed development.

The 4th site listed by FERS; The Boyne Coast and Estuary SA – please refer to above Section 1.1.3.

The River Boyne and River Blackwater cSAC is located ca. 4.3km (to the north) from the proposed development site. There is no hydrological connection to this European site as the Knockharley Stream drains to the south and discharges to the River Nanny. There are no woodland corridors linking the proposed development site to the River Boyne and River Blackwater cSAC. Agricultural lands, some of which are bordered by hedgerows and treelines are present in the landscape, however, existing infrastructure such as roads, buildings etc. intercept these features, breaking the link within the landscape. It is incorrect to state that hedgerows link the proposed development site to the River Boyne and River Blackwater cSAC.

The River Boyne and River Blackwater SPA is located ca. 4.4 km from the proposed development site and there is no hydrological connection or other ecological link to this European site.

The Boyne Coast and Estuary cSAC is located ca. 18.7km from the proposed development site, with no ecological link, such as a hydrological link or woodland corridor connecting the proposed development site to this European site.

The Boyne Estuary SPA is located ca. 14.6km from the proposed development site and, once again, has no ecological link (such as a hydrological link or woodland corridor) connecting the proposed development site to this European site.

Therefore these 4 no. European sites were screened out as there was no ecological connection or source-pathway-receptor link between the proposed development and these European Sites. Therefore, it was not necessary to consider these sites' conservation objectives as there is no possibility of any direct or indirect impacts to these sites from the proposed development.

For the avoidance of doubt, the conservation objectives of each of the four European sites appended to this document (Appendix 1).

It is reiterated that, in the circumstances where there is no ecological linkage or pathway between the site of the proposed development at Knockharley and any of these four European sites, there is no potential for direct or indirect impacts to any of the four European sites listed below:

- River Boyne and River Blackwater cSAC
- River Boyne and River Blackwater SPA
- Boyne Coast and Estuary cSAC
- Boyne Estuary SPA

1.1.5 Peer Review Report (FERS, 2019) Assertion Section 6.2.3.1

Section 6.2.3.1: The Appropriate Assessment screening report does not, at any time, explicitly identify a Source-Pathway-Receptor linkage between the proposed development sites and the five Natura 2000 sites taken into consideration.....This conclusion that these sites should be screened out is simply unfounded and incorrect and the applicant has no evidence (scientific or otherwise) in support of this conclusion.

Response

The Stage One Screening for Appropriate Assessment Report correctly states at Section 5.1 (Table 5.1) and Section 5.2 that there are no ecological linkages/pathways between the proposed development site and 4 no. European Sites. As set out above in Section 1.1.4 and in Table 5.1 and Section 5.2 of the Stage One Screening for Appropriate Assessment Report, there is no hydrological link or woodland corridors which could link the proposed development with any of these European sites. As there are no ecological linkage, it is not possible to have Source-Pathway-Receptor linkages. The only ecological link to a European Site is the hydrological connection between the Knockharley Stream which drains to the south and discharges to the River Nanny downstream and subsequently to the estuary and into the River Nanny Estuary and Shore SPA, ca. 22km downstream of the proposed development site. It is clear in the Stage One Screening for Appropriate Assessment Report that the potential effects on the River Nanny Estuary and Shore SPA arises as a result of the hydrological link between the two sites and hence the River Nanny Estuary and Shore SPA was "screened in" for Stage Two Appropriate Assessment.

1.1.6 Peer Review Report (FERS, 2019) Assertion Section 6.2.3.1 (1)

Section 6.2.3.1 (1): There are Otter, a qualifying interest of the River Boyne and River Blackwater (located less than 5km from the proposed development site), present within the site boundary. As indicated in the overview of Chapter 10 of the EIAR, there is potential for the Otter population present at the site of the proposed development to interact with, or indeed be part of, the population of Otter existing within the River Boyne and River Blackwater SAC through a complex network of drains, watercourses and hedgerows, thereby providing an ecological link between the proposed development site and the River Boyne and River Blackwater SAC.

Response

The only Annex II listed species noted during surveys for the proposed development was Otter. Otter occasionally use the streams draining the site for commuting and foraging (no holts / resting places and no breeding was noted over 3 years of surveys). These Otter are located outside of a European site, on the River Nanny catchment, with no connectivity to a SAC for which this species are a qualifying interest. The closest SAC designated for Otter is the River Boyne and River Blackwater cSAC 4.3km from the site but there is no hydrological or ecological connection. As these otters are outside of a European site with no connection to a European site they have been considered in the EIAR only. However, the potential effects (or lack thereof) to Otter within the River Boyne and River Blackwater cSAC have been considered in the Stage One Screening for Appropriate Assessment report where the site was 'screened out'.

Further Otter surveys were conducted in 2019 at the proposed development site (see Appendix 2). A low number of otter signs ($n=3$) were recorded along the watercourses in the vicinity of Knockharley Landfill during walkover surveys – refer to Table 1.1. No holts were identified during the surveys. This distribution of signs is supported by the poor fisheries habitat and low prey resources present on the smaller Flemingstown, Kentstown and Veldonstown Streams. Although unlikely to be used regularly, these watercourses may be utilised by commuting otter.

The surface water attenuation pond was evidently regularly used by otters, likely due to broader prey resources (i.e. stickleback, snails and small birds) in addition to typically lower levels of human disturbance (site fenced-off). Refer to Appendix 2 for the full report - Knockharley Landfill Aquatic Survey Report 2019.

While otter is present within the site, the site is not within the same catchment as the River Boyne and River Blackwater SAC. There are no hydrological links to the River Boyne and River Blackwater SAC meaning Otter cannot commute from the European site to Knockharley Landfill. Therefore, the possibility of any likely significant effects on Otter, or any European site for which the Otter is a qualifying interest, may be excluded.

Table 1-1: Locations of Otter Signs

| Nearest sampling points* | Watercourse | Otter sign | Sign age | Comments | ITM x | ITM y |
|--------------------------|--|------------------|----------|--|--------|--------|
| 1 | Knockharley surface water attenuation pond | Spraint | Mixed | Regular spraint site (10+) at culvert entrance to pond | 697504 | 766792 |
| 3 | River Nanny, R153 bridge (off-site) | Spraint | Old | Old spraint site on mid-channel rock u/s of bridge | 699873 | 764734 |
| 4 | River Nanny, East Bridge (off-site) | Spraint & prints | Fresh | Spraint & prints in paludal mud under 3 rd arch of bridge | 697625 | 764990 |

*points as listed in Knockharley Landfill Aquatic Survey Report 2019

1.1.7 Peer Review Report (FERS, 2019) Assertion Section 6.2.3.1 (2)

Section 6.2.3.1 (2): There are records of Kingfisher, the qualifying interest of the River Boyne and River Blackwater SPA recorded within the 10km square in which the proposed development is located, and indeed habitat suitable for Kingfisher within the site boundaries. There is potential for and Kingfisher population present at the site of the proposed development or environs to interact with, or indeed be part of, the population of Kingfisher existing within the River Boyne and River Blackwater SPA through a complex network of drains, watercourses and hedgerows, thereby providing an ecological link between the proposed development site and the River Boyne and River Blackwater SPA.

Response

Kingfisher recorded on the River Nanny are an Annex I species but are not a qualifying interest species for the River Nanny Estuary and Shore SPA. They are a qualifying interest species for the River Boyne and River Blackwater SPA. The potential for 'likely significant effects' to Kingfisher in the River Boyne and River Blackwater SPA was considered in the Stage One Screening for Appropriate Assessment report but there is no hydrological link between the proposed development site and the European site.

A dedicated Kingfisher survey was undertaken in 2019 at Knockharley Landfill. No Kingfishers were recorded during vantage point (VP) surveys across $n=4$ VP sites. However, a single kingfisher was recorded during walkover surveys. An adult bird was observed in flight heading upstream along the Flemingstown (Knockharley) Stream near the landfill boundary, between sites VP2 and VP3. Also, a single Kingfisher was observed in August 2019 during the summer transect survey at transect 2 at the inflow pipe culvert of the existing surface water attenuation pond within the site boundary. It remained on the pipe briefly and took off in a south easterly direction over deciduous forestry

Despite the presence (and observed local abundance) of three-spined stickleback within sections of the Flemingstown (Knockharley) Stream, Kentstown Stream and Veldonstown Stream, along with more diverse fish stocks in the River Nanny, Kingfisher habitat was typically considered sub-optimal for both breeding and feeding, although the River Nanny downstream may offer potential habitat for this species.

The smaller watercourses were invariably heavily overgrown (scrub vegetation) with steep but compacted banks that are not suitable for Kingfisher nesting (the birds require steep-sided, soft earth banks that allow them to excavate burrows). There was a noted scarcity of suitable perch sites along large sections of the River Nanny and smaller watercourses, heavily reducing its suitability as feeding habitat. No Kingfisher nesting sites were recorded during walkover surveys. Examination of the culvert into the existing surface water attenuation pond did not detect evidence of breeding activity during the summer. Due to the late date of the August sighting and the fact that no Kingfishers were observed during previous surveys at this location during the summer, it is thought that this sighting concerned a transient bird passing through, but not breeding at the existing facility. The Knockharley Bird Report (see Appendix 3) and the Knockharley Aquatic Report (see Appendix 2) containing the 2019 surveys are included in the Appendices.

As detailed above, there is poor nesting habitat available for Kingfisher within the proposed development site and no nesting sites were identified. As noted previously, there is no ecological link between the proposed development site and the River Boyne and River Blackwater SPA, for which the Kingfisher is a qualifying interest. The proposed development and the SPA are in separate catchments, so there is no mechanism by which activities at the proposed development can affect water quality at the River Boyne and River Blackwater SPA. Furthermore, Kingfishers are highly territorial. During the breeding season, they typically maintain territories 1 km in length (Fry *et al.* 1999). As the River Boyne and River Blackwater SPA is c. 4.6 km from the existing facility, it is highly unlikely any Kingfishers within the named SPA would use the existing facility for breeding, precluding the possibility of any significant negative effects on the SPA site.

FERS Ltd. is incorrect in its assertion that there is potential for any Kingfisher present at the site of the proposed development or environs to interact, be part of, the population of Kingfisher existing within the River Boyne and River Blackwater SPA, whether through the network of drains, watercourses and hedgerows, or at all.

There is no scientific uncertainty and the possibility of any likely significant effects on the River Boyne Estuary SPA has been correctly excluded in the Stage One Screening for Appropriate Assessment report.

1.1.8 Peer Review Report (FERS, 2019) Assertion Section 6.2.3.1 (3)

*Section 6.2.3.1 (3): The Appropriate Assessment Screening report identifies the potential for impacts on the conservation objectives of the qualifying interests of the River Nanny Estuary and Shore SPA through ecological connectivity. The Boyne Estuary SPA is located approximately 3.5km north of the River Nanny Estuary and Shore SPA and shares four bird species comprising qualifying interests with the River Nanny Estuary and Shore SPA. The bird species for which both the River Nanny Estuary and Shore SPA and Boyne Estuary SPA are designated are very mobile and feed both at the coast and inland – any potential impacts on the qualifying interests of one site have significant potential to impact on the other. There is therefore an ecological pathway between the proposed development site and the Boyne Estuary SPA. Also of note, as indicated in the overview of Chapter 10 of the EIAR, there is potential for the proposed development to impact on the foraging of Golden Plover (*Pluvialis apricaria*) a qualifying interest of both the River Nanny Estuary and Shore SPA and Boyne Estuary SPA.*

Response

The proposed development site is not hydrologically or ecologically linked to the Boyne Estuary SPA. The proposed development is linked to the River Nanny Estuary and Shore SPA via the Knockharley Stream which discharges to the River Nanny. The Boyne Estuary SPA receives flows from a separate catchment and hence there is no hydrological link nor any other ecological link between the proposed development and this European Site.

As detailed in Chapter 10 of Volume 2 of the EIAR and in Appendix 2 of the Natura Impact Statement, Golden Plover (*Pluvialis apricaria*) were recorded in arable fields adjacent to the site in previous surveys (Greenstar EIS, 2008), however, the habitats on the landfill site provide limited suitability for this species. This species has not been recorded in the site surveys in 2015, 2016, 2018 or 2019. The site is currently operational with ongoing construction activity for development of new cells and capping works, therefore there is active plant and equipment on site. While this activity will temporarily increase in the short-term during construction of the proposed development, this activity will reduce in the operational period. Due to the distance between the proposed development and the European site (ca. 22 km downstream and ca. 16.5 km direct distance) of the proposed development site., the possibility of significant effects on the bird species within the River Nanny Estuary and Shore SPA can be excluded.

1.1.9 Peer Review Report (FERS, 2019) Assertion Section 6.2.3.1 (4)

Section 6.2.3.1 (4): As indicated in the review of Chapter 10 of the EIAR, there is a detailed conservation objectives document available for the Boyne Coast and Estuary SAC. Within this document it is stated that "please note that this SAC overlaps with Boyne Estuary SPA (004080) and is adjacent to the River Boyne and River Blackwater SAC (002299)....the conservation objectives for this site should be used in conjunction with those for overlapping and adjacent sites as appropriate". Otter is recorded as occurring within the Boyne Coast and Estuary SAC (National Biodiversity Data Centre). Kingfisher is also recorded as occurring within the Boyne Coast and Estuary SAC (National Biodiversity Data Centre). These are both very mobile species. There is therefore, an ecological link between the proposed development site and the Boyne Coast and Estuary SAC.

Response

The proposed development site is ecologically linked via the Knockharley stream and the River Nanny to the River Nanny Estuary and Shore SPA. However, as detailed in the Stage One Screening for Appropriate Assessment report, the proposed development site is not ecologically linked to the Boyne Coast and Estuary cSAC. Moreover, as Section 5.2 states clearly:

Extending further than the 15km, the Boyne Coast and Estuary cSAC is located 18.7km from the site and is not ecologically connected and so there is no potential for direct or indirect impacts to this site.

1.1.10 Peer Review Report (FERS, 2019) Assertion Section 6.2.3.2 (1)

Section 6.2.3.2 Having failed to adequately identify the ecological links present between the proposed development site and the Natura 2000 sites present with the 'Zone of Influence' (which was never expressly identified in the Appropriate Assessment screening report) the assessment of potential significant direct, indirect and cumulative effects completely disregards:

- The River Boyne and River Blackwater SAC
- The River Boyne and Blackwater SPA
- The Boyne Estuary SPA
- The Boyne Coast and Estuary SAC

Rather than providing any scientific argument as to why there is no potential for impacts, the Appropriate Assessment screening simply states under the relevant headings that as regards these sites "There is no potential for significant effects on these Natura 2000 sites, as the proposed development has no ecological connectivity to these sites...." The Appropriate Assessment screening report therefore, fails to identify the potential direct, indirect or secondary impacts on any of these four Natura 2000 sites.

Response

The Stage One Screening for Appropriate Assessment Report more than adequately identifies the ecological links present between the proposed development site and the Natura 2000 sites present with the Zone of Influence.

Section 5.1 states: European Sites within 15km of the proposed development are detailed in Table 5.1, along with the distance from the site, the qualifying interests (SACs), special conservation interests (SPAs) and an evaluation as to whether there is a potential for impacts. Figure 5.1 illustrates the location of these sites in relation to Knockharley landfill. The 15km buffer was initially evaluated to determine the locations and connectivity to the proposed development site. The search area was then increased to encompass sites which were ecologically connected to the proposed development. Section 5.2 then includes relevant information on European sites that have an ecological/hydrological link to the proposed development beyond 15 km from the site.

Indeed, for the reasons set out in Table 5.1 and Section 5.2 of the Stage One Screening for Appropriate Assessment Report and, indeed, in this report, it is clear that there is no ecological linkage is present between the proposed development site and the European sites referenced above and this, self-evidently, is stated within the assessment.

As there is no ecological connection, there is no pathway and no potential for direct, indirect or secondary impacts on any of these sites and this is outlined in Table 5.4 Assessment of the Potential Significant Effects of the Proposed Project either Alone or in Combination with Other Plans or Projects on Natura 2000 Sites, of the Stage One Screening for Appropriate Assessment Report. Refer to 1.1.3 and 1.1.4 above which details how these sites are not ecologically connected with the proposed development site.

1.1.11 Peer Review Report (FERS, 2019) Assertion Section 6.2.3.2 (2)

Section 6.2.3.2: The Appropriate Assessment screening report does not identify any threats posed during the construction or operation phase of the landfill posed by potential introduction / spread of Alien Invasive Plant Species.

Response

Invasive plant species have not been identified within the proposed development footprint and therefore there is no increased potential for the spread of invasive plant species during the construction and operation of the facility. A stand of Himalayan Balsam was first identified in 2019 to the south west of the capped landfill outside of the proposed development footprint (see Appendix 4). The applicant shall ensure that this species, or indeed any other invasive species will not be introduced or spread during either the construction or operational phases of the proposed development.

As discussed in detail in Chapter 11 of Volume 2 of the EIAR, the vast majority of soils required for the proposed development will be site won. Any soil materials imported for construction will be specified in construction contracts. Waste accepted for recovery or disposal at the facility are and will be accepted in accordance with waste acceptance procedures in compliance with the IED Licence for the facility.

There is no potential for direct or indirect impacts on any qualifying interest of any European site to which the proposed development site is ecologically connected (or indeed to any European site) arising from the introduction or spread of invasive species which will, in any event, be prevented during both the construction and operational phases of the proposed development.

1.1.12 Peer Review Report (FERS, 2019) Assertion Section 6.2.3.2 (3)

Section 6.2.3.2: The Appropriate Assessment screening report does not indicate impacts associated with water requirements at the site. The processes being undertaken in the proposed development will require a significant quantity of water for treatment of dust etc. There is no indication in the Appropriate Assessment screening report as to the source of water for such operations in the event of a prolonged drought, such as that experienced in 2018. There is, therefore, no identification of potential impacts associated with potential water abstraction.

Response

Section 1.2.4 of Appendix 2 of the Stage One Screening for Appropriate Assessment report states: **The facility is connected to the water mains...**

There is no abstraction of water from Knockharley Stream, nor any proposal to abstract water. Water for dust suppression is obtained from the mains supply. In the event of a drought water would be abstracted from the southern surface water attenuation pond. To reiterate, rainwater falling on clean areas of the site is and will continue to be directed via the surface water management system to the surface water attenuation ponds where any solids can settle and the discharge from the site is passed from the pond through a wetland at a controlled rate. Leachate is and will continue to be managed as a completely separate system.

There is therefore no possibility of any effects on a European habitat as a result of water requirements on site.

1.1.13 Peer Review Report (FERS, 2019) Assertion Section 6.2.3.2 (4)

Section 6.2.3.2: The Appropriate Assessment screening report does not identify potential for indirect impacts caused by emissions associated with dust, which may arise as a result of a prolonged drought such as that experienced in 2018.

Response

As per Transport Infrastructure Ireland guidance (TII) (formerly NRA) – *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes*, for moderate sized construction sites (such as the proposed landfill) the potential for significant effects is limited to 50m from the source. For major construction sites, the distance is limited to 100m from the source. In circumstances where the nearest European site (the River Boyne and River Blackwater cSAC) is located is located ca. 4.3 km from the proposed development site, there is no potential for direct or indirect impacts from dust on any European Site.

The facility is licensed by the EPA and is conditioned to ensure dust does not cause a nuisance, there was no non-compliance for dust during the dry summer of 2018.

Condition 7.1 states: The licensee shall ensure that vermin, birds, flies, mud, dust, litter and odours do not give rise to nuisance at the facility or in the immediate area of the facility. Any method used by the licensee to control any such nuisance shall not cause environmental pollution. The licensee monitors dust in accordance with the licence.

1.1.14 Peer Review Report (FERS, 2019) Assertion Section 6.2.3.2 (5)

Section 6.2.3.2: The Appropriate Assessment screening report does not identify the potential for leachate, transported from the site to impact on water quality at any of the Natura 2000 sites examined, or indeed any other sites within the Natura 2000 network, as it is not specified in the Appropriate Assessment screening report where the leachate is tankered to, or what Natura 2000 sites might potentially be impacted on.

Response

All leachate is and will continue to be transported from Knockharley Landfill by contractors with a waste collection permit and brought to either a facility such as Enva WWTP with an EPA waste licence or an Irish Water WWTP in Ringsend, Navan or Drogheda which have discharge licence from the EPA. Accordingly, in circumstances where all leachate produced by the proposed development will be transported and disposed of in compliance with the Waste Management (Collection Permit) Regulations 2007 as amended and various EPA licence conditions, the possibility of any likely significant effect on any European site to which the proposed development site is ecologically linked, can be excluded.

1.1.15 Review Report (FERS, 2019) Assertion Section 6.2.3.2 (6)

Section 6.2.3.2: ...the existing restoration and aftercare plan as agreed under IE Licence W0146-02 is entirely redundant relative to the Appropriate Assessment screening of the proposed development. It must be noted that the EPA Industrial Emissions Licence application for the proposed development must be subject to Appropriate Assessment by the Environmental Protection Agency.

Response

Section 5.4.1 of the Stage 1 Screening for Appropriate Assessment details the following 'An existing closure restoration and aftercare management plan has been agreed with the EPA. This closure restoration and aftercare management plan **will be revised** to include the proposed development and is to be agreed with the EPA. It is indeed the case that the EPA Industrial Emissions Licence application for the proposed development must be subject to Appropriate Assessment by the Environmental Protection Agency. In that context, the potential for likely significant effects to arise from the implementation of the revised restoration and aftercare plan will be addressed in the Habitats Directive assessments carried out by the Environmental Protection Agency.

1.1.16 Review Report (FERS, 2019) Assertion Section 6.2.3.2 (7)

Section 6.2.3.2: As regards 'Cumulative and in-combination effects', the Appropriate Assessment screening report would appear to have largely omitted the potential for cumulative and in-combination effects of the proposed development and the existing development at Knockharley...The assessment of cumulative impacts has given no regard to, for example disturbance or bioaccumulation of contaminants. The assessment of cumulative and in-combination impacts is entirely insufficient despite the scoping response of the Department of Arts, Heritage and the Gaeltacht, and is a critical flaw of the Appropriate Assessment screening report.

Response

Once again, the assertion made in the FERS report is manifestly incorrect. Firstly, a cumulative assessment was undertaken as part of the Stage One Screening for Appropriate Assessment report. Section 5.4.1 of the report details the plans and projects that were considered in the assessment. Table 5.4 assesses the cumulative effects of the proposed development in combination with other plans and project (listed in Section 5.4.1). The following is stated in the report:

A potential significant effect to water quality during the construction and operation phase of the proposed development both alone or in combination with the other plans or projects (listed in Section 5.4.1 **including the existing landfill**), while unlikely, could ensue where the scale of magnitude of impacts is not known in the absence of mitigation measures.

Secondly, in terms of bioaccumulation, the pathway by which effects could potentially occur in the River Nanny Estuary and Shore SPA is via a deterioration in water quality and therefore this was the focus within the assessment. The surface water attenuation pond is for the retention of rainwater that falls on clean areas of the facility. It is attenuated to allow solids to settle and to allow the operator to control the rate of discharge from the site via the wetland to Knockharley Stream. The surface water attenuation pond is continuously monitored and is also sampled for a larger suit of parameters on a biannual basis.

The leachate lagoon is covered to prevent odours, but also serves to protect access by wildlife. The proposed lagoons and leachate tanks will be covered and importantly covered prior to the approval by the EPA for the acceptance of any leachate. Leachate is tankered off site for treatment at licensed WWTPs. There is no potential for bioaccumulation at Knockharley Landfill and therefore no potential for cumulative impacts. Accordingly, the possibility of any direct or indirect cumulative effects can be excluded.

Knockharley Landfill is an existing development with an existing level of activity. While this activity will increase temporarily in the short-term during construction, no significant effects are likely on the bird species within the River Nanny Estuary and Shore SPA which is located ca. 22km downstream (ca. 16.5km direct distance) of the proposed development site.

The issue of displacement of bird species was assessed (Section 5.4.3.1) as part of the Stage One Screening for Appropriate Assessment – including the potential for any displacement due to a reduction in food source. Section 5.4.3.1 states - Due to the distance between the proposed development (ca. 16.5 across land distance) birds within the River Nanny Estuary and Shore SPA (Site Code: 004158) will not be disturbed by activity at the proposed development site. There is a hydrological link between the proposed development and the SPA. Due to the distance (ca. 22km instream distance) and dilution factor it is extremely unlikely that a resultant adverse impact could ensue from the proposed development on birds for which the SPA is designated. However, the SPAs receiving habitat could potentially be adversely impacted indirectly if pollutants (during both the construction and operation phase) entered the watercourse downstream of the proposed development. This could result in the reduction of food source for birds (special conservation interests) which would result in the displacement in bird species. Based on the precautionary principle appropriate mitigation measures during the construction phase of the development would further reduce any potential risk. However, for the purposes of this Stage One Screening Report, no consideration has been given to such mitigation measures.

1.1.17 Review Report (FERS, 2019) Assertion Section 6.2.3.2 (8)

Section 6.2.3.2: As regards a description of any changes to the site arising, likely impacts on the Natura 2000 site as a whole, indicators of significance or those elements of the project or plan, or in combination of elements where impacts are likely to be significant or magnitude unknown, the conclusions of the Appropriate Assessment Screening report are entirely inaccurate, insufficient and not fit for purpose.

Response

Table 5.4 of the Stage One Screening for Appropriate Assessment report clearly and correctly identifies the correct approach taken of describing the individual elements of the project (either alone or in combination with other plans or projects) likely to give rise to significant effects on the Natura 2000 sites.

Cumulative or in-combination effects were also expressly described and assessed within Table 5.4 in relation to the plans and projects detailed in Section 5.4.1. By way of example only, potential cumulative and in-combination effects were considered in respect of the River Nanny Estuary and Shore SPA [European site code 004158] arising on water quality during the construction and operation phase. As noted above, it was concluded in the AA Screening Report that:

as a potential significant effect to water quality during the construction and operation phase of the proposed development both alone or in combination with the other plans or projects while unlikely was possible, the River Nanny Estuary and Shore SPA was correctly "screened in".

In respect of the other four European sites, it was correctly concluded that:

There is no potential for significant effects on these Natura 2000 sites, as the proposed development has no ecological connectivity to these sites.

The conclusions of the Stage One screening for assessment are accurate and deal comprehensively with the likely significant effects on the relevant European sites, including potential cumulative impacts.

1.1.18 Review Report (FERS, 2019) Assertion Section 6.2.3.2 (9)

Section 6.2.3.2: The failure of the Appropriate Assessment Screening report to identify potential impacts on the Boyne Estuary SPA alone, is evidence that the Appropriate Assessment Screening report was not undertaken based on the 'Precautionary Principal' as required by European law.

Response

The Stage One Screening for Appropriate Assessment report did consider the possibility of impacts on the River Boyne Estuary SPA. Indeed, as noted in the Stage One Screening for Appropriate Assessment, the principal pathway by which potential effects on Natura 2000 sites could occur was identified as via changes in water quality. However, the site of the proposed development drains to the Knockharley Stream, which discharges to the River Nanny, which in turn discharges to the River Nanny Estuary and Shore SPA ca. 22km downstream of the site. The River Boyne discharges to the River Boyne Estuary SPA. Therefore, there is no hydrological linkage to the River Boyne Estuary SPA and, moreover, due to the distance between the proposed development and the SPA, there is no potential for direct impacts to the SCI's of the SPA. In terms of the precautionary principle, which is generally understood to include the taking of measures in cases where scientific uncertainty exists as to the cause and extent of environmental impairment, in circumstances where there is no ecological connection between the proposed development site and the River Boyne Estuary SPA, there is no scientific uncertainty and the possibility of any likely significant effects on the River Boyne Estuary SPA has been correctly excluded in the AA Screening Report.

1.1.19 Review Report (FERS, 2019) Assertion Section 6.3

Section 6.3: Our review of the Appropriate Assessment Screening report submitted concludes that the information contained therein is critically flawed, containing numerous lacunae. The Appropriate Assessment Screening report cannot, therefore, be utilised to reliably inform the Appropriate Assessment process and the preparation of a robust and scientifically accurate and precise determination of the potential impact of the proposed development upon the Natura 2000 network through a Natura Impact Statement.

Response

The FERS Report asserts, in a general and non-specific manner, that the Stage One Screening for Appropriate Assessment report contained *lacunae*. However, by way of example only, it is clear that the Stage 1 Screening for Appropriate Assessment correctly identified the ecological linkage between the proposed development and the River Nanny Estuary and Shore SPA.

The linkage is via drainage from the site to the Knockharley Stream which discharges to the River Nanny and to the estuary ca. 22km downstream of the site. In addition, as correctly identified in the Stage One Screening for Appropriate Assessment report, there is no other European site ecologically linked via watercourses or corridors (such as woodland) to the proposed development site. The Stage One Screening for Appropriate Assessment carried out on behalf of the developer was robust, accurate and based on best available scientific knowledge. All likely significant effects were identified and assessed. The FERS report has not identified any matter which undermines or contradicts the content of the Stage One Screening for Appropriate Assessment report.

The Stage One Screening for Appropriate Assessment report followed and implemented the requirements of European Union and Irish national law and guidance.

The Stage One Screening for Appropriate Assessment report correctly identified that there is a remote risk to the River Nanny Estuary and Shore SPA as a result of indirect significant effects via a hydrological link from the proposed development, in the absence of mitigation measures. There is also the remote possibility of cumulative effects on water quality as a result of construction impacts from residential, agricultural and industrial activities within the catchment area of River Nanny Estuary and Shore SPA (site code 004158). In coming to this conclusion, no consideration was given to mitigation measures.

In circumstances where it could not be excluded, on the basis of objective scientific information, that the proposed development, individually or in combination with other plans or projects, will not have a significant effect on the River Nanny Estuary and Shore SPA, that European site was "screened in" for Stage Two Appropriate Assessment. However, for the reasons set out in detail in the AA Screening Report, all other European sites were "screened out". Whilst it is a matter for the Board (as competent authority) to carry out both the Stage One Screening and Stage Two Appropriate Assessment, it is the Applicant's position that the Stage One Screening appraisal undertaken on its behalf is more than adequate to enable the competent authority to carry out the Stage One Screening assessment required.

Moreover, as a result of the robust Stage One screening appraisal undertaken on its behalf, the developer identified that, in its view and the view of its consultants, there is an obligation on the competent authority to carry out an Appropriate Assessment (i.e., Stage Two of the AA process) and, in this context, a Natura Impact Statement was completed, on behalf of Knockharley Landfill Ltd. and was submitted to the respective competent authorities with the applications for development consent, with respect to River Nanny Estuary and Shore SPA (site code 004158).

It was definitively and correctly concluded in the Stage One Screening for Appropriate Assessment report that the possibility may be excluded of significant effects on the remaining four European sites identified for consideration, either alone or in combination with other plans or projects. As there is no ecological connectivity between the project site and any of these four European sites, and these sites are located a very considerable distance from the proposed development site, there is no necessity for an appropriate assessment of the proposed development. Accordingly, the Board is enabled to determine that an appropriate assessment of the proposed development is not required in respect of any European site other than the River Nanny Estuary and Shore SPA (site code 004158) as it can be excluded, on the basis of objective information, that the proposed development, individually or in combination with other plans or projects, will have a significant effect on any other European site (including the four other European sites considered in the Stage One Screening for Appropriate Assessment report).

2 RESPONSE TO FERS REPORT ON NATURA IMPACT STATEMENT

2.1 Reponses on Natura Impact Statement (NIS)

2.1.1 Review Report (FERS, 2019) Assertion Section 7.1

Section 7.1: The proposed development will, therefore, produce more leachate, which must be taken into account in the Appropriate Assessment screening.

Response

Please note that whilst the above assertion relates to Stage One Screening for Appropriate Assessment, it is contained within Section 7 Review of Natural Impact Statement (NIS) in the FERS report and therefore the response is included here.

The Stage One Screening for Appropriate Assessment report detailed that more leachate would be produced – Appendix 2, Section 1.4.3.5. However, it was correctly concluded in the Stage One Screening for Appropriate Assessment report that, with only one exception, an appropriate assessment of the proposed development is not required in respect of any European site as it can be excluded, on the basis of objective information, that the proposed development, individually or in combination with other plans or projects, will have a significant effect on any European site, whether arising from leachate or otherwise.

Only in relation to one European site, i.e., the River Nanny Estuary and Shore SPA, was a remote risk identified, as a result of indirect significant effects via a hydrological link from the proposed development and, accordingly, in the Stage One Screening for Appropriate Assessment report that European site was “screened in” for Stage Two Appropriate Assessment.

In the context of the Stage Two Appropriate Assessment, to be undertaken by the competent authority, the Natura Impact Statement (NIS) submitted with the application for permission identified appropriate mitigation measures to ensure that leachate produced during the operational phase of the proposed development will not adversely affect the River Nanny Estuary and Shore SPA.

As per Section 2.7.2.2 of the NIS - it is proposed to upgrade the current tanker loading facility to facilitate collection of treated or untreated leachate from the lagoons and tanks on-site within the leachate treatment facility. This will allow filling of two tankers concurrently.

Each tank / lagoon will have a valved discharge pipe that will terminate in the tanker loading area at a manifold.

The vacuum tanker or similar will drive into the tanker loading area and a flexible pipe will connect the tanker to the manifold. Typically, a vacuum in the tanker facilitates removal of effluent from respective tanks.

The tanker loading area will retain and connect to the in-situ below ground drainage system to accommodate, as required, spills and runoff from this area which will be discharged to the in-situ leachate lagoon for subsequent treatment and or transfer off site to a waste water treatment facility.

Tankers for the transport of leachate are filled within bunded areas and therefore do not present a risk, as the tankers are not filled in proximity to surface waters within the site. The tankers transport leachate to fully consented EPA licensed waste water treatment plants for treatment, where standard protocols are in place for the movement of leachate from the tanker and into the treatment plant. Both Irish Water and private wastewater treatment companies are consented for the treatment and discharge of waste water.

In all the circumstances as detailed in the NIS, having conducted the required Stage Two Appropriate Assessment, the Board is enabled to determine that leachate produced as a result of the operation of the proposed development will not adversely affect the integrity of a European site.

2.1.2 Review Report (FERS, 2019) Assertion Section 7.1(2)

Section 7.1: Another example is the detailed description of the nature of leachate being produced and the management of leachate. It is stated on page 53 of the NIS that “.. Netting and/or floating covers to prevent mammals drinking contaminated storm water...” are not shown in the diagrams. There is, however, no indication as to measures to prevent smaller organisms, such as insects accessing this contaminated storm water. In addition to the threat posed to the food-chain through bioaccumulation of toxins, this could pose a direct threat to human health...

Response

Firstly the above sentence “.. Netting and/or floating covers to prevent mammals drinking contaminated storm water...” has been cut short, the actual sentence on page 53 of the NIS is Figure 2.9 shows Netting and/or floating covers to prevent mammals drinking contaminated storm water have been omitted for clarity.

As described in the following sections of the NIS and as reiterated previously in Sections 2.1.12 and 2.1.12 of this report leachate and surface water are managed separately at the facility and will continue to be managed separately in accordance with the EU Directive on the landfill of waste, the Waste Management Act 1996, as amended and the IED licence for the facility W0146-02 and any future revision thereof.

Section 2.2.7 states: The leachate lagoon (see Plate 2-4) has a floating cover to prevent rainfall ingress and to minimise odour nuisance. The lagoon is lined with 2 mm HDPE membrane on a 1 m clay layer. The capacity of the leachate lagoon is approximately 2,500 m³, with an allowance for a 0.75 m freeboard. Leachate is tankered off-site for treatment at a wastewater treatment plant. Plate 2.1 below is copied from Section 2.2.7 of the NIS. This is the existing leachate lagoon with a floating cover, any future lagoons will be built to the same specification (See Section 2.7 of the NIS for references to floating cover lagoons and of course a suite of detailed drawings in Appendix 4 of the NIS) and approved for use by the EPA prior to acceptance of leachate. It is a sealed system preventing any access by invertebrates or larger fauna. The proposed leachate tanks are shown in Drawing No. LW14-821-01-P-0103-004 Rev A Tank Farm and Leachate Treatment Equipment Elevations (showing roofs on all tanks) of Appendix 4 of the NIS and the layout was shown as Drawing No. LW14-821-01-P-0600-001 Rev A Proposed Leachate Management Facility.

The existing clean surface water management system is described in Section 2.2.8 of the NIS. The proposed holding pond described in Section 2.8 is a separate pond to the clean surface water attenuation ponds. It is designed to hold surface water to ensure via continuous monitoring on the outfall to the clean surface water attenuation pond that the water is clean. If there is a decrease in water quality, the valve is closed and water is directed to the covered leachate lagoons and tanks. There will not therefore be a ‘contaminated surface water pond’ on site serving as a water source for fauna.



Plate 2-1: Covered Leachate Lagoon

It is noted that risks to human health are outside the scope of the NIS. In circumstances where none of these smaller organisms, including insects, constitute a qualifying interest for any European site. It is also well-established that a Stage Two Appropriate Assessment involves an assessment as to whether a proposed development will adversely affect the integrity of a European site or sites and does not involve an assessment of human health. Indeed, the wholly misconceived reference to human health is indicative of the level of analysis contained in the FERS Report in relation to the proposed development and the suite of application documentation submitted with the application for permission, including the AA Screening Report and NIS.

2.1.3 Review Report (FERS, 2019) Assertion Section 7.2

Section 7.2: ...all the relevant Natura 2000 sites with the potential to be impacted upon have not been identified and are not considered.

Response

The Stage 1 Screening for Appropriate Assessment considered the following sites:

- River Boyne and River Blackwater SPA (site code 004232)
- Boyne Estuary SPA (site code 004080)
- River Boyne and River Blackwater SAC (site code 002299)
- Boyne Coast and Estuary SAC (001957)
- River Nanny Estuary and Shore SPA (004158)

Please also refer to repeated responses in Sections 1.1.4, 1.1.5, 1.1.6, 1.1.7, 1.1.8, 1.1.9, 1.1.10, 1.1.17 and 1.1.18.

For the reasons set out in detail in the Stage One Screening for Appropriate Assessment report, and having considered all submissions and observations made on the application for permission, the Board is enabled to determine that an appropriate assessment of the proposed development is not required in respect of any European site – other than the River Nanny Estuary and Shore SPA (site code 004158) – as it can be excluded, on the basis of objective information, that the proposed development, individually or in combination with other plans or projects, will have a significant effect on any other European site (including the four other European sites considered in the Stage One Screening for Appropriate Assessment report).

2.1.4 Review Report (FERS, 2019) Assertion Section 7.3

Section 7.3: The NIS.....has not based the assessment of the potential impacts of the proposed development on the conservation objectives of the qualifying interests of the site in question (River Nanny Estuary and Shore SPA) on the most current available conservation status of the site.

Response

The conservation objectives for the site that were used in the assessment were the most current available - NPWS (2012) *Conservation Objectives: River Nanny Estuary and Shore SPA 004158*. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht. Information was also obtained from the *Conservation Objectives Supporting Document Version 1*, NPWS, September 2012. FT notes that the Natura 2000 standard data form contains updated bird population data (dated 09-2017). However, this does not materially affect the findings of the Natura Impact Statement (it is an update on bird counts), as it was demonstrated that there would be no adverse impact on any of the special conservation interests of the SPA, following the implementation of mitigation measures to prevent water quality impacts. For the avoidance of any doubt, all conservation objectives applicable to the River Nanny Estuary and Shore SPA are appended to this document (Appendix 1).

2.1.5 Review Report (FERS, 2019) Assertion Section 7.4.2.1

Section 7.4.2.1: The introduction and / or spread of propagules of Alien Invasive Plant Species, such as Japanese Knotweed, Himalayan Balsam or Giant Hogweed (which was highlighted in the Department of Arts, Heritage and the Gaeltacht scoping response) does, however have the potential to impact on erosion and sedimentation processes as well as directly impacting species composition of wetland habitats. The nature of the existing and proposed development would indicate a significant potential for the import and spread of these species in the absence of mitigation measures and in particular an Alien Invasive Plant Species Control and Management Plan.

Response

As indicated in Appendix 2 Field Surveys of the NIS, invasive plant species were not present within the proposed development site and there is no potential for the spread of invasive plant species during the construction and operation of the facility. A stand of Himalayan Balsam was identified in 2019 (see Appendix 4) to the south west of the capped landfill and the applicant will engage a suitable qualified contractor to treat and/or remove these plants – this area is outside of the proposed development site.

As discussed in detail in Chapter 11 of Volume 2 of the EIAR, the vast majority of soils required for the proposed development will be site won. Any soil materials imported for construction will be specified in construction contracts. Waste accepted for recovery or disposal at the facility are and will be accepted in accordance with waste acceptance procedures in compliance with the IED Licence for the facility. The facility has been operational since 2004, having been constructed in advance, and to date the operator has managed invasive species on site.

There is no potential for direct or indirect impacts on any qualifying interest of any European site to which the proposed development site is ecologically connected (or indeed to any European site) arising from the introduction or spread of invasive species which will, in any event, be prevented during both the construction and operational phases of the proposed development.

2.1.6 Review Report (FERS, 2019) Assertion Section 7.4.2.2

Section 7.4.2.2; The inadequacies of the Biodiversity Chapter of the EIAR and Appropriate Assessment screening report have the result that the potential for the proposed development to impact on the foraging behaviour of several species, which are qualifying interests of the River Nanny, including Golden Plover, a species listed on Annex I of the EU Birds Directive, which has been recorded foraging adjacent to the site. Contrary to the findings of the NIS, there is potential for impacts associated with disturbance or displacement of species that are Qualifying Interests of the River Nanny Estuary and Shore SPA.

Response

The Stage One Screening for Appropriate Assessment report (section 5.4.3.1) clearly states that the River Nanny Estuary and Shore SPA (Site Code: 004158) has been designated for, inter alia, Golden Plover (*Pluvialis apricaria*). The Stage One Screening for Appropriate Assessment report also considered the unmitigated adverse impacts to conservation status of the Golden Plover and concluded that the possible occurrence of potentially unmitigated adverse impacts on the integrity of the *River Nanny Estuary and Shore SPA* cannot be ruled out during the construction and operation phases of the proposed development. Accordingly, the River Nanny Estuary and Shore SPA (Site Code: 004158) was "screened in" for Stage Two Appropriate Assessment.

The proposed development site is not hydrologically linked to the Boyne Estuary SPA. The proposed development is linked to the River Nanny Estuary and Shore SPA via the Knockharley Stream which discharges to the River Nanny. The Boyne Estuary SPA receives flows from a separate catchment and hence there is no hydrological link.

As detailed in Chapter 10 of Volume 2 of the EIAR and in Appendix 2 of the Natura Impact Statement, Golden Plover (*Pluvialis apricaria*) was recorded in arable fields adjacent to the site in previous surveys (Greenstar EIS, 2008), however, the habitats on the landfill site provide limited suitability for this species.

During the breeding season the species is found in heather moors, blanket bogs and acidic grasslands of north and west Ireland, with a low overall breeding density in the country (Balmer *et al.* 2013). This species has not been recorded in the site surveys in 2015, 2016, 2018 or 2019.

The site is currently operational with ongoing construction activity for development of new cells and capping works, therefore there is active plant and equipment on site. While this activity will temporarily increase in the short-term during construction of the proposed development, this activity will reduce in the operational period. Due to the distance between the proposed development and the European site (ca. 22 km downstream and ca. 16.5 km direct distance) of the proposed development site., the possibility of significant effects on the bird species within the River Nanny Estuary and Shore SPA can be excluded.

It is acknowledged that the four bird species (Oystercatcher *Haematopus ostralegus*, Golden Plover *Pluvialis apricaria*, Knot *Calidris canutus* and Sanderling *Calidris alba*) shared by the two SPA sites are highly mobile. However, if no significant effects are envisaged for bird species within the River Nanny Estuary and Shore SPA, then logically, no significant effects can be envisaged for bird species within the Boyne Estuary SPA either. Finally, SNH guidance (SNH, 2016) states that the core range of Golden Plover is 3 km, with maximum range of 11 km. As both SPA sites are over 11 km direct distance from the existing facility, it is highly unlikely Golden Plovers from either SPA site are utilising habitat surrounding the existing facility in large numbers.

The issue of potential displacement of bird species was specifically considered as part of the Stage One Screening for Appropriate Assessment (see Section 5.4.3.1). Indeed, potential displacement due to a reduction in food source was assessed and the possibility of a likely significant effect occurring was excluded. However, the SPAs receiving habitat could potentially be adversely impacted indirectly if pollutants (during both the construction and operation phase) entered the watercourse downstream of the proposed development. This could result in the reduction of food source for birds (special conservation interests) which would result in the displacement in bird species. Based on the precautionary principle appropriate mitigation measures during the construction phase of the development would further reduce any potential risk. However, for the purposes of this Stage One Screening Report, no consideration was given to such mitigation measures. As part of the Stage Two AA, mitigation measures were detailed in the NIS in Table 3.5 which will prevent water quality effects and thus feeding areas for bird species will not be negatively affected. For ease of reference, Table 3.5 is replicated below as Table 2.1 in this report:

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Table 2-1: Replicated Table 3-5 (NIS) Details of Mitigation Measures for Construction Phase

| Mitigation Measure | How Measure Will Avoid Adverse Effects | Implementation of Mitigation Measure | Monitoring scheme to reduce the risk of mitigation failure |
|---|--|---|---|
| The new attenuation pond will be put in place at the commencement of construction at the site. | Eliminate the risk any increase in the rate of runoff, erosion control and silt and/or polluted runoff control | In the event that development consent is granted, all mitigation measures set out in the EIAR and NIS will be conditioned as part of the development consent granted and will be included as a contractual obligation on the contractor, in combination with competent supervisory staff overseeing the works and have been included in the outline CEMP. | A suitably qualified person will be appointed by the developer to ensure the effective management and maintenance of mitigation measures during the construction process. |
| Site drainage, including silt traps and stilling ponds, will be put in place in parallel with or ahead of construction. | Control run-off and erosion and trap silt. | As above | As above |
| The 4-stage treatment train (swale – holding pond-attenuation pond- wetland/diffuse outflow) will retain and treat the discharges from the new surfaces as a result of the development. | Control flooding, control run-off and erosion and trap silt going into the Knockharley Stream | As above | As above |
| During the permitted stream diversion and culverting, in-stream sedimentation traps will be positioned prior to construction and maintained for the duration. All diverted water /run-off can be sent to the onsite surface water attenuation lagoon. | Avoid risk of sediment entering the Knockharley stream | As above | As above |
| Additional silt fencing and silt-prevention measures will be kept on site for use in emergencies. | Avoid risk of failure of silt-based mitigation in the case fencing fails or more is required. | As above | As above |
| No work will take place on site during severe weather conditions. | Avoid risk of silt/pollution contaminated runoff. | As above | As above |

| Mitigation Measure | How Measure Will Avoid Adverse Effects | Implementation of Mitigation Measure | Monitoring scheme to reduce the risk of mitigation failure |
|---|--|--------------------------------------|--|
| All fuels will be kept in bunded areas. Any diesel or fuel oils stored on site will be bunded to 110 % of the capacity of the storage tank in accordance with the facilities waste licence. Design and installation of fuel tanks to be in accordance with best practice guidelines BPGCS005, oil storage guidelines. | Avoid the risk of hydrocarbon leaks and contaminate runoff entering the Knockharley Stream. | As above | As above |
| Re-fuelling of plant during construction will be carried out in a designated refuelling area. Each station is fully equipped for a spill response and a specially trained and dedicated environmental and emergency spill response team is in place on site. | Avoid the risk of hydrocarbons to enter the Knockharley Stream | As above | As above |
| Only emergency breakdown maintenance will be carried out on site and appropriate containment facilities will be provided to ensure that any spills from breakdown maintenance vehicles are contained and removed off site. Drip trays and spill kits will be kept available on site, to ensure that any spills from the vehicle are contained and removed off site. | Avoid the risk of hydrocarbons to enter the Knockharley Stream | As above | As above |
| During construction, daily visual inspections will be performed. If sediment appears to be entering streams, work will stop immediately and measures to identify the source will be undertaken and measures undertaken to stop further sediment entering the stream. | Avoid the risk of sediment entering the Knockharley Stream. | As above | As above |
| The construction of flood culvert within the Knockharley Stream | Designed to provide storage for the flood plain storage lost through constructing the northern surface water management system in a 1:1000-year flood plain. | As above | As above |

| Mitigation Measure | How Measure Will Avoid Adverse Effects | Implementation of Mitigation Measure | Monitoring scheme to reduce the risk of mitigation failure |
|---|--|--------------------------------------|--|
| <p>During stream diversion and culverting, vegetation clearance will be kept to a minimum and in-stream sedimentation traps will be positioned prior to construction and maintained for the duration. All diverted water /run-off can be sent to the onsite surface water attenuation lagoon if required. Any in-stream works will be undertaken in consultation with the Planning Authority and Inland Fisheries Ireland (IFI) and subject to Section 50 approval from the OPW. In consideration of fisheries resources downstream, works in watercourses will be carried out during the period July-September unless prior agreement has been reached with IFI.</p> | <p>Avoid the risk of sediment entering the stream.</p> | <p>As above</p> | <p>As above</p> |
| <p>Where required, portaloo and/or containerised toilets will be used in combination with existing site welfare facilities and associated waste water management facilities to provide toilet facilities for site personnel during construction. Sanitary waste produced by portaloo/containerised toilets will be removed from site via a licensed waste disposal contractor.</p> | <p>Prevent potential run-off being contaminated by sanitary waste.</p> | <p>As above</p> | <p>As above</p> |
| <p>The soil stability will also be assessed at site specific locations particularly at stockpile, screening berms and stream bank locations where earthworks are proposed. Best practices will be employed.</p> | <p>Prevent silt laden run-off from entering Knockharley Stream.</p> | <p>As above</p> | <p>above</p> |

| Mitigation Measure | How Measure Will Avoid Adverse Effects | Implementation of Mitigation Measure | Monitoring scheme to reduce the risk of mitigation failure |
|--|--|--------------------------------------|--|
| <p>Silt Protection Controls (SPCs) are proposed at the location of watercourse crossings and where access roads pass close to watercourses during construction. Silt fencing will be used at the flowing locations:</p> <ol style="list-style-type: none"> All stockpile material will be bunded adequately and/or surrounded by silt fences and protected from heavy rainfall to reduce silt run-off, where necessary. All open water bodies adjacent to proposed construction areas will be protected by fencing, including the proposed attenuation pond. along the banks of any streams at the location of the proposed tree felling to provide additional protection to the watercourses in this area. | <p>Prevent any contamination of Knockharley Stream.</p> | <p>As above</p> | <p>As above</p> |
| <p>Standing water, which may arise in excavations, has the potential to contain an increased concentration of suspended solids as a result of the disturbance to soils. The excavations will be pumped into the site drainage system (including attenuation ponds), after which permanent insitu dewatering will be implemented during</p> | <p>Prevent the overland flow of contaminated water into the Knockharley Stream</p> | <p>As above</p> | <p>As above</p> |
| <p>operations. As historically there is little evidence of high inflows, it is anticipated that pumped flows from excavations will be very low. Bio-degradable silt bags (or equivalent approved) will be used during dewatering of excavations.</p> | <p>Consent of copyright owner required for any other use.</p> | | |
| <p>Swales will be shallow. Temporary silt traps will also be provided at regular intervals in the swales.</p> | <p>To minimize the disturbance to sub-soils and the production of silt thereby preventing silt contaminating the Knockharley Stream.</p> | <p>As above</p> | <p>As above</p> |
| <p>Tree felling will be undertaken in accordance the felling licence and the specifications set out in the Forest Service Guidelines (34) and Forest Harvesting and Environmental Guidelines (36).</p> | <p>To ensure a tree clearance method that avoids the risk of sediment and nutrient runoff.</p> | <p>As above</p> | <p>As above</p> |

| Mitigation Measure | How Measure Will Avoid Adverse Effects | Implementation of Mitigation Measure | Monitoring scheme to reduce the risk of mitigation failure |
|---|--|--------------------------------------|--|
| Trees will be felled away from aquatic zones where possible. Branches, logs or debris will not be allowed to accumulate in aquatic zones and will be removed as soon as possible. | Prevent the introduction of excess nutrients into the Knockharley Stream | As above | As above |
| Berms to be developed on the deforested areas immediately following felling, followed by replanting. | Avoid the risk of a significant increase in the rate of run-off into the Knockharley Stream. | As above | As above |
| The outfall from the constructed wetland will have vertical pipe drop energy dissipation structure within the wetland outlet chamber prior to discharge into the adjacent launching apron protection works. | This design approach will avoid the risk of suspended solids developing within the Knockharley stream downstream of the outfall. | As above | As above |
| Rock armour will be used to provide bank protection works upstream and downstream of new structures. | To ensure no undercutting or destabilisation of either the structure or riparian bank areas occurs thereby ensuring that sediment will not be released into the Knockharley Stream | As above | As above |
| All personnel currently working on site are trained in pollution incident control response and this will be a requirement of the construction contract(s). | Avoid the risk of pollutants entering the Knockharley Stream. | As above | As above |
| Appropriate information will be available on site outlining the spillage response procedure and a contingency plan to contain silt. | Avoid the risk of silt/pollutants entering the Knockharley Stream. | | As above |
| Adequate security will be provided to prevent spillage as a result of vandalism. | Avoid the risk of pollutants entering the Knockharley Stream. | As above | As above |
| A regular review of weather forecasts of heavy rainfall is required, and a contingency plan will be prepared for before and after such events. | Avoid the risk of pollutants entering the Knockharley Stream. | As above | As above |

| Mitigation Measure | How Measure Will Avoid Adverse Effects | Implementation of Mitigation Measure | Monitoring scheme to reduce the risk of mitigation failure |
|--|--|--------------------------------------|--|
| <p>A suitably qualified person will be appointed by the developer to ensure the effective implementation of the CEMP onsite. They will also ensure:</p> <p>b. regular monitoring of the drainage system and maintenance as required.</p> <p>Record keeping of the daily visual examinations of watercourses which receive flows from the proposed development, during and for an agreed period after the construction phase.</p> <p>e. Water quality monitoring will continue to be carried out in accordance with the licence. (There will be one new monitoring point, at the discharge point from the new wetland.)</p> | <p>Ensure mitigation measures are effectively implemented.</p> | <p>As above</p> | <p>As above</p> |
| <p>If excessive suspended solids are noted, construction work will be stopped, and remediation measures will be put in place immediately.</p> | <p>To allow for the immediate correction of any underperforming mitigation and avoid a risk of impact to the water quality of Knockharley Stream</p> | <p>As above</p> | <p>As above</p> |
| <p>Discharges from paved roads paved areas will be surrounded by filter drains with petrol interceptors installed at respective outlets upstream of the storm water management attenuation ponds or other.</p> | <p>Allow for the collection and removal of hydrocarbons from site, preventing them entering the Knockharley Stream</p> | <p>As above</p> | <p>As above</p> |

2.1.7 Review Report (FERS, 2019) Assertion Section 7.4.2.1(2)

Section 7.4.2.1: The NIS does not, however, identify that the introduction and/or spread of propagules of Alien Invasive Native Species, such as Japanese Knotweed, Himalayan Balsam or Giant Hogweed...during the operational phase of the proposed development has to impact on loss and/or alteration of habitat.

Response

As indicated in Appendix 4, invasive plant species are not present within the proposed development site footprint and there is no potential for the spread of invasive plant species during the construction and operation of the facility. A stand of Himalayan Balsam was identified in 2019 to the south west of the capped landfill and the applicant will engage a suitable qualified contractor to treat and/or remove these plants – this area is outside of the proposed development site.

As discussed in detail in Chapter 11 of Volume 2 of the EIAR, the vast majority of soils required for the proposed development will be site won. Any soil materials imported for construction will be specified in construction contracts. Waste accepted for recovery or disposal at the facility are and will be accepted in accordance with waste acceptance procedures in compliance with the IED Licence for the facility. The facility has been operational since 2004, having been constructed in advance, and to date the operator has managed invasive species on site.

There is no potential for direct or indirect impacts on any qualifying interest of any European site to which the proposed development site is ecologically connected (or indeed to any European site) arising from the introduction or spread of invasive species which will, in any event, be prevented during both the construction and operational phases of the proposed development.

2.1.8 Review Report (FERS, 2019) Assertion Section 7.4.2.2(2)

Section 7.4.2.2: ...the potential for the proposed development to impact during the operational phase on the foraging behaviour of several species, which are qualifying interests of the River Nanny, including Golden Plover, a species listed on Annex I of the EU Birds Directive, which has been recorded foraging adjacent to the site.

Response

Knockharley landfill is an existing operational facility with ongoing activities within the site; the operational phase will be similar in terms of activity within the site. The proposed development will not result in the loss of quality habitat for foraging birds. As detailed in the Chapter 10 of Volume 2 of the EIAR and in Appendix 2 of the NIS, Golden Plover (*Pluvialis apricaria*) was recorded in arable fields adjacent to the site in previous surveys (Greenstar EIS, 2008), however the habitats on the landfill site provide limited suitability for this species. This species has not been recorded in the site in 2015, 2016, 2018 or 2019. As this species has not been identified within the site of the proposed development, there is no issue arising in relation to the proposed development displacing the species from that site.

Refer also to responses 1.1.8 and 2.1.6 in this report.

2.1.9 Review Report (FERS, 2019) Assertion Section 7.4.2.3

7.4.2.3 The NIS does not, however, identify potential impacts on water quality during the operational phase associated with the tankering of leachate off-site. There is no indication as to the final destination of the leachate or routes taken, and as such no way to identify Natura 2000 sites potentially at risk, the potential risk of impacts to such sites, or mitigation measures.

Response

The leachate is and will be transported by waste collection permit holders to fully consented waste water treatment plants (WWTPs). Leachate is currently transported to Ringsend WWTP (D0034-01) or Enva WWTP (W0192-03) in Dublin, or to Navan WWTP (D0059-01) in Meath or Drogheda WWTP (D0041-01) in Louth. The 3 no. WWTPs operated by Irish Water have an EPA licence to discharge. The Enva facility in Dublin has an IED licence to operate.

It is anticipated that leachate from Knockharley Landfill will continue to be transported to one or more of these 4 no. facilities. The assessment of activities at each WWTP has been completed by WWTP operators which include Irish Water and the private sector under a waste licence from the EPA in their applications to the EPA for Waste Water Discharge Authorisations. Leachate is discharged to the WWTP inlet in accordance with the effluent acceptance procedures at each WWTP. Leachate from all landfills in Ireland is tankered or pumped to WWTPs usually for full or final treatment.

Section 2.7.2.5 of the NIS states that there will be up to 14. no daily traffic movements of leachate in either 25 tonne or 15 tonne rigid tankers. Leachate is transported by a waste contractor with a waste collection permit that authorises transport of leachate.

2.1.10 Review Report (FERS, 2019) Assertion Section 7.4.3

Section 7.4.3: There is currently no agreed closure restoration and aftercare management plan as regards the proposed development. It is, therefore, not possible to scientifically assess any potential impacts to the Natura 2000 network posed by the closure, restoration and aftercare management plan – this is a critical flaw in the conclusion of the NIS.

Response

Section 2.16.3 of the NIS states: On closure, the landfill body will be capped, and the area returned to vegetation in compliance with Closure, Restoration and Aftercare plans agreed with the Agency.

As part of the facility licence review, the existing Closure, Restoration and Aftercare plan will be revised to account for the new elements of development i.e. increased waste acceptance, IBA cell development, biological treatment plan development etc.' and Section 3.3.1.3 states 'An existing closure restoration and aftercare management plan has been agreed with the EPA. This closure restoration and aftercare management plan **will be revised** to include the proposed development and is to be agreed with the EPA.'

It should be noted that the application for an IED licence in respect of the proposed development will itself be subjected to Habitats Directive assessments to be undertaken by the Environmental Protection Agency, including in relation to the revised restoration and aftercare management plan.

It is also noted that the EPA cannot commence its review of the EIAR and appraisal of the Stage One and Stage Two Appropriate Assessments until An Bord Pleanála has completed its assessment and made a decision.

It is yet again reiterated, repeating the conclusions of the Stage One Screening for Appropriate Assessment, the NIS and many of the preceding responses in this document that in circumstances where it could not be excluded, on the basis of objective scientific information, that the proposed development, individually or in combination with other plans or projects, will not have a significant effect on the River Nanny Estuary and Shore SPA, that European site was "screened in" for Stage Two Appropriate Assessment. However, for the reasons set out in detail in the Stage One Screening for Appropriate Assessment report, all other European sites were "screened out". The surface water management system and leachate management systems will continue to operate under licence from the EPA during the closure, restoration and aftercare period until the facility is decommissioned which is typically 30 years post closure. The landfill is constantly being restored, as each cell is completed, reaches final settlement height, it is capped in accordance with the licence (and the EU Directive on the landfill of waste) and is restored to grassland, to date (October 2019) 109,000 m² of the landfill has a final cap. The restoration of the facility is an iterative ongoing process.

2.1.11 Review Report (FERS, 2019) Assertion Section 7.4.5

Section 7.4.5: It must be indicated that, the proposed development is linked ecologically to several other Natura 2000 sites, which have not been considered. For example, the cumulative impact on disturbance and / or displacement of Otter, one of the Qualifying Interests of the River Boyne and River Blackwater SAC, located less than 5km from the development and linked ecologically to the development through a network of watercourses, drainage ditches and hedgerows.

Response

As is demonstrated in the Stage One Screening for Appropriate Assessment, the only European site which has an ecological linkage with the proposed development is the River Nanny Estuary and Shore SPA.

The River Boyne and River Blackwater cSAC (references in section 7.4.5 of the FERS Report) is located ca. 4.3km to the north of the proposed development site. There is no hydrological connection to this European Site as the Knockharley Stream drains to the south. There are no woodland corridors linking the proposed development site to this SAC. Agricultural lands, some of which are bordered by hedgerows and treelines are present in the landscape, however, existing infrastructure such as roads, buildings etc. intercept these features, breaking the link within the landscape.

It is incorrect to state that hedgerows link the proposed development site to the River Boyne and River Blackwater cSAC. In the absence of any ecological link between the site of the proposed development and the River Boyne and River Blackwater SAC the possibility of any impact (cumulative or otherwise) can be excluded on any of the qualifying interests of that European site, including the Otter.

The River Boyne and River Blackwater SPA is located ca. 4.4km from the proposed development site and there is no hydrological connection or other ecological link to this SPA.

The Boyne Coast and Estuary cSAC is located ca. 18.7km from the proposed development site, with no ecological link such as a hydrological link or woodland corridor connecting the proposed development site to this SAC.

The Boyne Estuary SPA is located ca. 14.6km from the proposed development site with no ecological link such as a hydrological link or woodland corridor connecting the proposed development site to this SPA.

2.1.12 Review Report (FERS, 2019) Assertion Section 7.4.5(2)

Section 7.4.5: Even as regards the River Nanny Estuary and Shore SPA, the NIS has failed to identify the potential cumulative impacts of disturbance and/or displacement on the foraging of bird species that are qualifying interests of the River Nanny Estuary and Shore SPA. The assessment of cumulative effects has not been undertaken in a manner such as to provide any robust, scientific conclusions.

Response

The assertion made by FERS, in relation to potential cumulative impacts on the bird species that are qualifying interests of the River Nanny Estuary and Shore SPA, is incorrect.

Firstly, Knockharley Landfill facility is currently operational and so plant and machinery is active within the site. While this activity will increase temporarily in the short-term during construction, this will reduce in the operational phase. Section 3.3.1.1 of the NIS details the potential for disturbance or displacement of the special conservation interest of the SPA during construction, Section 3.3.1.2 details the potential for effects during the operational phase and Section 3.4 includes details on the potential for cumulative effects. It was concluded that, due to the distance between the proposed development (ca. 16.5 km across land distance), birds within the *River Nanny Estuary and Shore SPA (Site Code: 004158)* will not be disturbed by activity at the proposed development site.

Whilst there is a hydrological link between the proposed development and River Nanny Estuary and Shore SPA, due to the very considerable distance (ca. 22km instream distance) and dilution factor, there will not be any adverse effects on the integrity of that European site from the proposed development, including the birds species within the European site for which the SPA is designated. However, the SPA's receiving habitat could potentially be adversely impacted indirectly if pollutants (during both the construction and operation phase) entered the watercourse downstream of the proposed development. This could potentially result in the reduction of food source for birds (special conservation interests) which could potentially result in the displacement of bird species.

Accordingly, in this context, and based on the precautionary principle, effective mitigation measures will be implemented during the construction phase which will have the effect of ensuring that there will no adverse effects on qualifying interests of the River Nanny Estuary and Shore SPA, whether those bird species are located within or outside the European site itself.

These mitigation measures are detailed in Tables 3.5 and 3.6 of the NIS (Table 3.5 is replicated as Table 2.1 in this report and Table 3.6 is replicated as Table 2.2 in this section - which are set out below for ease of reference). Following the implementation of mitigation measures, the conservation objectives for the SPA were assessed to determine if there would be any adverse impact and this appraisal is detailed in Table 3.7 of the NIS. In terms of population trend, it was assessed that following the implementation of surface water mitigation and design measures detailed in Tables 3.5 and 3.6 of the NIS, detrimental effects on water quality in the Knockharley Stream will not occur and therefore there will be no adverse effect downstream. Therefore, potential adverse effects affecting prey and feeding for the SCIs will not occur. As no adverse impacts will occur, the long-term population trend will not be affected. In terms of distribution, as there will be no water quality effects, no effects on prey and feeding will occur, so the distribution of bird species will not change as a result of the proposed development.

Section 3.4 of the NIS details the plans and projects included in the cumulative assessment. A detailed review of relevant plans and projects in the vicinity of the proposed development was conducted. The appraisal concluded as follows:

Of the projects detailed above, one-off housing, extensions and alterations will not give rise to adverse effects on the integrity of the European Site. The proposed solar farm at Knockharley will not give rise to any discharges to watercourses. New wastewater treatment systems with suitable percolation areas to groundwater are likely to prevent significant impacts to hydrogeological connected surface waters. In terms of the EPA licensed facilities, each facility is subject to controls to prevent adverse effects on watercourses and the downstream SPA. Following the implementation of measures set out in the proceeding section and the limits imposed by the EPA under licences there will be no adverse effects on the River Nanny Estuary and Shore SPA. In addition, there is a large dilution factor between the proposed development and the SPA.

The Draft County Meath Biodiversity Action Plan 2015-2020 aligns with the objectives in the Meath County Development Plan in terms of implementing the requirements of the Habitats Directive. These plans, their objectives and policies will aid in ensuring that cumulative effects on European Sites do not result in adversely affecting the integrity of European Sites and any future developments will require in the first instance Stage One Screening for Appropriate Assessment and if required, a NIS to allow the planning authority to conduct an Appropriate Assessment.

In all the circumstances, the Board is enabled to determine that there will be no adverse effects, including cumulative effects, on any European site from the proposed development.

Table 2. 1: Replication of Table 3.6 (NIS) Details of Mitigation Measures for Operational Phase

| Mitigation Measure | How Measure Will Avoid/Reduce Impacts Adverse | Implementation of Mitigation Measure and Likely Success | Monitoring scheme to reduce the risk of mitigation failure |
|--|--|---|---|
| All surface water run-off from the permitted development will flow through an existing class 1 interceptor. Surface water will discharge from the interceptor to the existing attenuation pond and wetland provided for the landfill. Additional Class 1 interceptors will be provided for the proposed development at outfalls from filter drains surrounding the IBA facility. | This petrol interceptor will prevent chemical and petroleum products from entering the attenuation and wetland system downstream and avoid the risk contaminated water being discharged to Knockharley Stream. | In the event that development consent is granted, all mitigation measures set out in the EIAR and NIS will be conditioned as part of the development consent granted and the developer will be required to ensure their efficacious implementation. | A suitably qualified person will be appointed by the developer to ensure the effective management and maintenance of mitigation measures. |
| Bypass chambers in the road drainage system surrounding the IBA facility will direct contaminated storm runoff into the adjacent IBA facility cell 32 at two locations during IBA operations. | Prevent any IBA contaminated run-off from entering the existing attenuation pond and avoid the risk of contaminated water being discharged to Knockharley Stream. | As above | As above |
| Both (existing "Southern" and proposed "Northern") surface water attenuation ponds are / will be sized to manage a 1 in a 100-year storm, in accordance with the GSDSDS guidelines (2). | Avoid the risk of the system being flooded and prevent uncontrolled release of collected run-off into the Knockharley Stream. | As above | As above |
| Constructed wetlands downstream of the existing "Southern" and proposed "Northern" attenuation ponds will receive surface water discharges to further attenuate flows and 'polish' storm water suspended solids before discharge to the Knockharley Stream. | Allow run-off containing silt to settle out and prevent potential release into the Knockharley Stream. | As above | As above |
| A combination of roof and pavement storm water will be managed. There are a number of SuDS features proposed such as filter strips, filter drains and rainwater harvesting from the roof of the biological treatment facility and stored in tanks, for grey water usage. | To provide an effective system to prevent storm water runoff entering the Knockharley Stream. | As above | As above |

| Mitigation Measure | How Measure Will Avoid/Reduce Impacts | Implementation of Mitigation Measure and Likely Success | Monitoring scheme to reduce the risk of mitigation failure |
|---|--|---|--|
| All fuels are to be kept in bunded areas. Any diesel or fuel oils stored on site will be bunded to 110 % of the capacity of the storage tank in accordance with the facilities waste licence. Design and installation of fuel tanks to be in accordance with best practice guidelines BPGCS005, oil storage guidelines. | Prevent biofuels from entering the Knockharley Stream | As above | As above |
| There is continuous monitoring of total organic carbon, pH and conductivity on the "Southern" surface water attenuation pond discharge and there is an automated shut-off of discharge in the event of exceedance of the trigger level for TOC which is 20 mg/l. | Prevent any contaminated run-off from being released into the Knockharley Stream. | As above | As above |
| There will be continuous monitoring of total organic carbon, pH, turbidity and conductivity on the "Northern" surface water holding pond discharge and there will be an automated shut-off of discharge in the event of an exceedance of the trigger level which will be initially set at 20 mg/l TOC | Prevent any contaminated run-off from being released into the Knockharley Stream. | As above | As above |
| Ongoing biannual surface water physio-chemical and annual biological monitoring will be undertaken in accordance with the licence conditions. | Allow for the monitoring of effective mitigation by comparing the results of upstream and downstream monitoring locations. | As above | As above |
| In the event of a pollution incident onsite, the discharge from the existing "Southern" surface water pond can be shut down to prevent pollution entering the watercourse. In the event of a pollution incident on the proposed "Northern" development the discharge from the holding pond and attenuation pond can be shut down to prevent pollution entering the watercourse. | Prevent polluted water from being discharged into the Knockharley Stream | As above | As above |
| In the event of an upstream pollution event off-site, there is also a diversion device at the "Southern" outfall on the Knockharley stream to allow the stream to be diverted into the sites pollution control infrastructure, if required. | To prevent pollution upstream of the Knockharley Stream entering the River Nanny. | As above | As above |

| Mitigation Measure | How Measure Will Avoid/Reduce Impacts Adverse | Implementation of Mitigation Measure and Likely Success | Monitoring scheme to reduce the risk of mitigation failure |
|---|---|---|--|
| In the event of an upstream pollution event off-site, there is also a diversion device at the "Southern" outfall on the Knockharley stream to allow the stream to be diverted into the sites pollution control infrastructure, if required. | To prevent pollution upstream of the Knockharley Stream entering the River Nanny. | As above | As above |
| Inspection and maintenance of the surface water management system including swales, culverts, rainwater harvesting tank filters and outfalls will be undertaken regularly. | Ensure no blockages have occurred and the system is operating correctly. | As above | As above |
| In keeping with the IED licence, regular visual inspections and monitoring will be required of the surface water management system. | This will avoid any risk of potential impacts on the Knockharley Stream. | As above | As above |
| The conceptual drainage has been designed to operate effectively during the operational period. Surface water run-off will discharge to the drainage swales during rain events. During the operation period the swales will have vegetated and will serve to further attenuate flows and reduce the amount of sediment discharging from the site. The attenuation ponds will be permanent features and will continue to be effective in filtering the run-off from the site should any accidental release of silt combine with the surface water run-off during operational activities. | Drainage swales will prevent the free flow of runoff from rain events and their vegetation will further attenuate water and filter silt from runoff, avoiding the risk of contamination to the Knockharley Stream runoff and silt which enters the surface water attenuation lagoons. | As above | As above |
| Surface water runoff from the IBA facility perimeter road will be directed to the IBA weathering area leachate collection system to avoid dust contamination of drainage outfalls. | This will prevent IBA dust from entering into the surface water attenuation lagoon and avoid the risk of it entering the Knockharley Stream. | As above | As above |

| Mitigation Measure | How Measure Will Avoid/Reduce Impacts Adverse | Implementation of Mitigation Measure and Likely Success | Monitoring scheme to reduce the risk of mitigation failure |
|---|---|--|--|
| <p>The mitigation measures applicable for spills during the construction phase are applicable during the operational phase. In the event of a leachate spill from a tanker, spill kits are kept on site and site staff are trained in the management of a spill. The haulage contractor will be required to have spill kits and training. There will be regular inspections and maintenance of leachate tankers to mitigate leaks. In the event of an unforeseen road traffic accident resulting in a leachate spill adjacent to a watercourse, Meath County Council and Inland Fisheries shall be contacted and spill protection measures will be implemented.</p> | <p>Avoid the risk of the pollutants from potential spill event entering the Knockharley Stream</p> | <p>As above</p> | <p>As above</p> |
| <p>Surface water will be visually inspected as part of the operational site walkovers on a weekly basis. There will be continuous monitoring of surface water quality at the outfall from the surface water attenuation ponds to the wetland. Routine surface water sampling is and will continue to be carried out in accordance with the licence which includes the submission of interpretive reports to the EPA for approval. Any incidents shall be notified to the EPA in accordance with the licence.</p> | <p>Monitor the effectiveness of the waste water management system to ensure silt/pollutants do not enter the Knockharley Stream.</p> | <p>As above</p> | <p>As above</p> |
| <p>All surface water run-off from the permitted development will flow through an existing class 1 interceptor. Surface water will discharge from the interceptor to the existing attenuation pond and wetland provided for the landfill. Additional Class 1 interceptors will be provided for the proposed development at outfalls from filter drains surrounding the IBA facility.</p> | <p>This petrol interceptor will prevent chemical and petroleum products from entering the attenuation and wetland system downstream and avoid the risk contaminated water being discharged to Knockharley Stream.</p> | <p>In the event that development consent is granted, all mitigation measures set out in the EIAR and NIS will be conditioned as part of the development consent granted and the developer will be required to ensure their efficacious implementation.</p> | <p>A suitably qualified person will be appointed by the developer to ensure the effective management and maintenance of mitigation measures.</p> |

| Mitigation Measure | How Measure Will Avoid/Reduce Impacts | Implementation of Mitigation Measure and Likely Success | Monitoring scheme to reduce the risk of mitigation failure |
|---|---|---|--|
| Bypass chambers in the road drainage system surrounding the IBA facility will direct contaminated storm runoff into the adjacent IBA facility cell 32 at two locations during IBA operations. | Prevent any IBA contaminated run-off from entering the existing attenuation pond and avoid the risk of contaminated water being discharged to Knockharley Stream. | As above | As above |
| Both (existing "Southern" and proposed "Northern") surface water attenuation ponds are / will be sized to manage a 1 in a 100-year storm, in accordance with the GSDS guidelines (2). | Avoid the risk of the system being flooded and prevent uncontrolled release of collected run-off into the Knockharley Stream. | As above | As above |
| Constructed wetlands downstream of the existing "Southern" and proposed "Northern" attenuation ponds will receive surface water discharges to further attenuate flows and 'polish' storm water suspended solids before discharge to the Knockharley Stream. | Allow run-off containing silt to settle out and prevent potential release into the Knockharley Stream. | As above | As above |
| A combination of roof and pavement storm water will be managed. There are a number of SuDS features proposed such as filter strips, filter drains and rainwater harvesting from the roof of the biological treatment facility and stored in tanks, for grey water usage. | To provide an effective system to prevent storm water runoff entering the Knockharley Stream. | As above | As above |
| All fuels are to be kept in bunded areas. Any diesel or fuel oils stored on site will be bunded to 110 % of the capacity of the storage tank in accordance with the facilities waste licence. Design and installation of fuel tanks to be in accordance with best practice guidelines BPGCS005, oil storage guidelines. | Prevent biofuels from entering the Knockharley Stream | As above | As above |
| There is continuous monitoring of total organic carbon, pH and conductivity on the "Southern" surface water attenuation pond discharge and there is an automated shut-off of discharge in the event of exceedance of the trigger level for TOC which is 20 mg/l. | Prevent any contaminated run-off from being released into the Knockharley Stream. | As above | As above |

| Mitigation Measure | How Measure Will Avoid/Reduce Impacts Adverse | Implementation of Mitigation Measure and Likely Success | Monitoring scheme to reduce the risk of mitigation failure |
|---|---|---|--|
| There will be continuous monitoring of total organic carbon, pH, turbidity and conductivity on the "Northern" surface water holding pond discharge and there will be an automated shut-off of discharge in the event of an exceedance of the trigger level which will be initially set at 20 mg/l TOC | Prevent any contaminated run-off from being released into the Knockharley Stream. | As above | As above |
| Ongoing biannual surface water physio-chemical and annual biological monitoring will be undertaken in accordance with the licence conditions. | Allow for the monitoring of effective mitigation by comparing the results of upstream and downstream monitoring locations. | As above | As above |
| In the event of a pollution incident onsite, the discharge from the existing "Southern" surface water pond can be shut down to prevent pollution entering the watercourse. In the event of a pollution incident on the proposed "Northern" development the discharge from the holding pond and attenuation pond can be shut down to prevent pollution entering the watercourse. | Prevent polluted water from being discharged into the Knockharley Stream | As above | As above |
| In the event of an upstream pollution event off-site, there is also a diversion device at the "Southern" outfall on the Knockharley stream to allow the stream to be diverted into the sites pollution control infrastructure, if required. | To prevent pollution upstream of the Knockharley Stream entering the River Nanny. | As above | As above |
| Inspection and maintenance of the surface water management system including swales, culverts, rainwater harvesting tank filters and outfalls will be undertaken regularly. | Ensure no blockages have occurred and the system is operating correctly. | As above | As above |
| In keeping with the IED licence, regular visual inspections and monitoring will be required of the surface water management system. | This will avoid any risk of potential impacts on the Knockharley Stream. | As above | As above |
| The conceptual drainage has been designed to operate effectively during the operational period. Surface water run-off will discharge to the drainage swales during rain events. During the operation period the swales will have vegetated and will serve to further attenuate flows and reduce the amount of sediment discharging from the site. The attenuation ponds will be permanent features and will continue to be effective in filtering the run-off from the site should any accidental release of silt combine with the surface water run-off during operational activities. | Drainage swales will prevent the free flow of runoff from rain events and their vegetation will further attenuate water and filter silt from runoff; avoiding the risk of contamination to the Knockharley Stream runoff and silt which enters the surface water attenuation lagoons. | As above | As above |

| Mitigation Measure | How Measure Will Avoid/Reduce Impacts Adverse | Implementation of Mitigation Measure and Likely Success | Monitoring scheme to reduce the risk of mitigation failure |
|--|--|---|--|
| Surface water runoff from the IBA facility perimeter road will be directed to the IBA weathering area leachate collection system to avoid dust contamination of drainage outfalls. | This will prevent IBA dust from entering into the surface water attenuation lagoon and avoid the risk of it entering the Knockharley Stream. | As above | As above |
| The mitigation measures applicable for spills during the construction phase are applicable during the operational phase. In the event of a leachate spill from a tanker, spill kits are kept on site and site staff are trained in the management of a spill. The haulage contractor will be required to have spill kits and training. There will be regular inspections and maintenance of leachate tankers to mitigate leaks. In the event of an unforeseen road traffic accident resulting in a leachate spill adjacent to a watercourse, Meath County Council and Inland Fisheries shall be contacted and spill protection measures will be implemented. | Avoid the risk of the pollutants from potential spill event entering the Knockharley Stream | As above | As above |
| Surface water will be visually inspected as part of the operational site walkovers on a weekly basis. There will be continuous monitoring of surface water quality at the outfall from the surface water attenuation ponds to the wetland. Routine surface water sampling is and will continue to be carried out in accordance with the licence which includes the submission of interpretive reports to the EPA for approval. Any incidents shall be notified to the EPA in accordance with the licence. | Monitor the effectiveness of the waste water management system to ensure silt/pollutants do not enter the Knockharley Stream. | As above | As above |

2.1.13 Review Report (FERS, 2019) Assertion Section 7.4.5(3)

Section 7.4.5: the assessment of cumulative impacts has given no regard to, for example, bioaccumulation of contaminants. The assessment of cumulative and in-combination impacts is entirely insufficient despite the scoping response of the Department of Arts, Heritage and the Gaeltacht, and is a critical flaw of the Natura Impact Statement

Response

A cumulative assessment was undertaken in Section 3.4 of the NIS and details the plans and projects that were considered in the assessment. The pathway by which effects could occur in the River Nanny Estuary and Shore SPA is via a deterioration in water quality and therefore, correctly, this was the focus within the assessment.

The Knockharley landfill is an existing development with an existing level of activity. While this activity will increase in the temporary-short term during construction, no significant effects are likely on the bird species within the River Nanny Estuary and Shore SPA which is located ca. 22km downstream (ca. 16.5km direct distance) of the proposed development site. Displacement of bird species was assessed (Section 3.3.1.1 of the NIS) as part assessment – their displacement due to a reduction in food source was assessed - Due to the distance between the proposed development (ca. 16.5 km across land distance) birds within the *River Nanny Estuary and Shore SPA (Site Code: 004158)* will not be disturbed by activity at the proposed development site. There is a hydrological link between the proposed development and SPA.

Due to the distance (ca. 22km instream distance) and dilution factor it is extremely unlikely that a resultant adverse impact could ensue from the proposed development on birds for which the SPA is designated. However, the SPAs receiving habitat could potentially be adversely impacted indirectly if pollutants (during both the construction and operation phase) entered the watercourse downstream of the proposed development. This could result in the reduction of food source for birds (special conservation interests) which would result in the displacement in bird species. Based on the precautionary principle appropriate mitigation measures during the construction phase of the development will further reduce any potential risk.

Secondly, in terms of bioaccumulation, the pathway by which effects could potentially occur in the River Nanny Estuary and Shore SPA is via a deterioration in water quality and therefore this was the focus within the assessment. The surface water attenuation pond is for the retention of rainwater that falls on clean areas of the facility. It is attenuated to allow solids to settle and to allow the operator to control the rate of discharge from the site via the wetland to Knockharley Stream. The surface water attenuation pond is continuously monitored and is also sampled for a larger suit of parameters on a biannual basis.

The leachate lagoon is covered to prevent odours, but also serves to protect access by wildlife. The proposed lagoons and leachate tanks will be covered. Leachate is tankered off site for treatment at licensed WWTPs. There is no potential for bioaccumulation at Knockharley Landfill and therefore there is no potential for cumulative impacts. Accordingly, the possibility of any direct or indirect cumulative effects can be excluded. Please also refer to response 2.1.2 of this document which again summarises some of the detail in relation to the proposed development as described in Section 2 of the NIS.

2.1.14 Review Report (FERS, 2019) Assertion Section 7.6

The FERS report states that the conservation status of qualifying interests, the proposed mitigation measures, the cumulative impacts are not fit for purpose.

Response

These statements are incorrect.

The only site, that in any way, is ecologically connected with the proposed development site is the River Nanny Estuary and Shore SPA. The remaining sites were "screened out" due to the absence of ecological connectivity and due to distance. The Stage 1 Screening for Appropriate Assessment found that there is a remote risk to the River Nanny Estuary and Shore SPA as a result of indirect significant effects via a hydrological link from the proposed development, in the absence of mitigation measures.

The NIS assessed whether there would be adverse impacts on the River Nanny Estuary and Shore SPA and site integrity, in view of its conservation objectives. A detailed suite of mitigation measures were proposed, as identified in the NIS in Section 3.5 and reproduced in this report as Table 2.1 for ease of reference, including design measures to ensure that no water quality impacts occur in relation to the Knockharley Stream, in order that no downstream effects occur. These mitigation measures were developed in line with good practice and industry guidance.

Section 3.6.1 of the NIS details the guidance documents used and concludes that in circumstances where the mitigation measures referenced are implemented, and which have been developed in light of the best scientific knowledge as detailed in the guidelines, and which are tried and tested over time, no scientific doubt remains to the *absence* of any adverse impacts caused by the proposed development either alone or in combination with other plans or projects, on the integrity of the River Nanny Estuary and Shore SPA.

A cumulative assessment was undertaken in Section 3.4 of the NIS and details the plans and projects that were considered in the assessment. The pathway by which effects could occur in the River Nanny Estuary and Shore SPA is via a deterioration in water quality and therefore, correctly, this was the focus within the assessment.

2.1.15 Review Report (FERS, 2019) Assertion Section 7.6 (2)

7.6 The FERS report concludes that: *based on the information contained within the Natura Impact Statement submitted, the Competent Authorities cannot determine that the proposed development will not adversely affect the integrity of any relevant European site.*

Response

This statement is incorrect. The NIS contained all relevant information in terms of the proposed development; the relevant European site in question; the pathways by which effects could occur; a cumulative assessment with other plans and projects; a suite of best practice and proven mitigation measures and design measures so as to prevent adverse effects on the integrity of the SPA; and an assessment of the conservation objectives for the River Nanny Estuary and Shore SPA. The authors correctly concluded that:

- (i) all aspects of the proposed development project have been identified which, in the light of the best scientific knowledge in the field, could by themselves or in combination with other plans or projects, affect the European site in the light of its conservation objectives;
- (ii) there are complete, precise and definitive findings and conclusions regarding the identified potential effects on any relevant European site;
- (iii) on the basis of those findings and conclusions, the competent authorities are able to determine that no scientific doubt remains as to the absence of the identified potential effects; and
- (iv) thus, the competent authorities may determine that the proposed development will not adversely affect the integrity of any relevant European site.

Appendix 1

Qualifying Interests of Boyne Coast and Estuary SAC
Special Conservation Interests of the Boyne Estuary SPA
Special Conservation Interest of the River Nanny Estuary
and Shore SPA
Conservation objectives European Sites

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Qualifying Interests

* indicates a priority habitat under the Habitats Directive

| | |
|--------|---|
| 001957 | Boyne Coast and Estuary SAC |
| 1130 | Estuaries |
| 1140 | Mudflats and sandflats not covered by seawater at low tide |
| 1310 | Salicornia and other annuals colonizing mud and sand |
| 1330 | Atlantic salt meadows (<i>Glauco-Puccinellietalia maritimae</i>) |
| 1410 | Mediterranean salt meadows (<i>Juncetalia maritimi</i>) |
| 2110 | Embryonic shifting dunes |
| 2120 | Shifting dunes along the shoreline with <i>Ammophila arenaria</i> ('white dunes') |
| 2130 | *Fixed coastal dunes with herbaceous vegetation ('grey dunes') |

Qualifying Interests

* indicates a priority habitat under the Habitats Directive

| | |
|--------|--|
| 004080 | Boyne Estuary SPA |
| A048 | Shelduck <i>Tadorna tadorna</i> |
| A130 | Oystercatcher <i>Haematopus ostralegus</i> |
| A140 | Golden Plover <i>Pluvialis apricaria</i> |
| A141 | Grey Plover <i>Pluvialis squatarola</i> |
| A142 | Lapwing <i>Vanellus vanellus</i> |
| A143 | Knot <i>Calidris canutus</i> |
| A144 | Sanderling <i>Calidris alba</i> |
| A156 | Black-tailed Godwit <i>Limosa limosa</i> |
| A162 | Redshank <i>Tringa totanus</i> |
| A169 | Turnstone <i>Arenaria interpres</i> |
| A195 | Little Tern <i>Sterna albifrons</i> |
| A999 | Wetlands |

Qualifying Interests

* indicates a priority habitat under the Habitats Directive

| | | |
|--------|--|-----------|
| 004158 | River Nanny Estuary and Shore SPA | |
| A130 | Oystercatcher <i>Haematopus ostralegus</i> | wintering |
| A137 | Ringed Plover <i>Charadrius hiaticula</i> | wintering |
| A140 | Golden Plover <i>Pluvialis apricaria</i> | wintering |
| A143 | Knot <i>Calidris canutus</i> | wintering |
| A144 | Sanderling <i>Calidris alba</i> | wintering |
| A184 | Herring Gull <i>Larus argentatus</i> | wintering |
| A999 | Wetlands | |

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National Parks and Wildlife Service

Conservation Objectives Series

Boyne Coast and Estuary SAC 001957

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An Roinn
Ealaíon, Oidhreachta agus Gaeltachta
Department of
Arts, Heritage and the Gaeltacht



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Citation:

NPWS (2012) Conservation Objectives: Boyne Coast and Estuary SAC 001957. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

**Series Editors: Rebecca Jeffrey & Naomi Kingston
ISSN 2009-4086**

Introduction

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network.

European and national legislation places a collective obligation on Ireland and its citizens to maintain habitats and species in the Natura 2000 network at favourable conservation condition. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites.

A site-specific conservation objective aims to define favourable conservation condition for a particular habitat or species at that site.

The maintenance of habitats and species within Natura 2000 sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those habitats and species at a national level.

Favourable conservation status of a habitat is achieved when:

- its natural range, and area 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 favourable conservation status of a species is achieved 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.

Notes/Guidelines:

1. The targets given in these conservation objectives are based on best available information at the time of writing. As more information becomes available, targets for attributes may change. These will be updated periodically, as necessary.
2. An appropriate assessment based on these conservation objectives will remain valid even if the targets are subsequently updated, providing they were the most recent objectives available when the assessment was carried out. It is essential that the date and version are included when objectives are cited.
3. Assessments cannot consider an attribute in isolation from the others listed for that habitat or species, or for other habitats and species listed for that site. A plan or project with an apparently small impact on one attribute may have a significant impact on another.
4. Please note that the maps included in this document do not necessarily show the entire extent of the habitats and species for which the site is listed. This should be borne in mind when appropriate assessments are being carried out.
5. When using these objectives, it is essential that the relevant backing/supporting documents are consulted, particularly where instructed in the targets or notes for a particular attribute.

Qualifying Interests

* indicates a priority habitat under the Habitats Directive

| | |
|--------|---|
| 001957 | Boyne Coast and Estuary SAC |
| 1130 | Estuaries |
| 1140 | Mudflats and sandflats not covered by seawater at low tide |
| 1310 | Salicornia and other annuals colonizing mud and sand |
| 1330 | Atlantic salt meadows (<i>Glauco-Puccinellietalia maritimae</i>) |
| 1410 | Mediterranean salt meadows (<i>Juncetalia maritimi</i>) |
| 2110 | Embryonic shifting dunes |
| 2120 | Shifting dunes along the shoreline with <i>Ammophila arenaria</i> ('white dunes') |
| 2130 | *Fixed coastal dunes with herbaceous vegetation ('grey dunes') |

Please note that this SAC overlaps with Boyne Estuary SPA (004080) and is adjacent to the River Boyne and River Blackwater SAC (002299). See map 2. The conservation objectives for this site should be used in conjunction with those for overlapping and adjacent sites as appropriate.

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Supporting documents, relevant reports & publications (listed by date)

Supporting documents, NPWS reports and publications are available for download from: www.npws.ie/Publications

Title: Boyne Coast and Estuary SAC (001957). Conservation objectives supporting document - marine habitats. [Version 1]

Year: 2012

Author: NPWS

Series: Unpublished Report to NPWS

Title: Boyne Coast and Estuary SAC (001957). Conservation objectives supporting document - coastal habitats. [Version 1]

Year: 2012

Author: NPWS

Series: Unpublished Report to NPWS

Title: An intertidal soft sediment survey of the Boyne Coast and Estuary

Year: 2011

Author: ASU

Series: Unpublished Report to NPWS & MI

Title: Benthic Survey of the Boyne Coast and Estuary Special Area of Conservation and Boyne Estuary Special Protection Area

Year: 2011

Author: EcoServe

Series: Unpublished Report to NPWS & MI

Title: Saltmarsh Monitoring Report 2007-2008

Year: 2009

Author: McCorry, M.; Ryle, T.

Series: Unpublished Report to NPWS

Title: Coastal Monitoring Project 2004-2006

Year: 2009

Author: Ryle, T.; Murray, A.; Connolly, C.; Swann, M.

Series: Unpublished Report to NPWS

Title: The phytosociology and conservation value of Irish sand dunes

Year: 2008

Author: Gaynor, K.

Series: Unpublished PhD thesis, National University of Ireland, Dublin

Spatial data sources

| | |
|------------------------|--|
| Year: | 2010 |
| Title: | EPA WFD transitional waterbody data |
| GIS operations: | Clipped to SAC boundary. Expert opinion used as necessary to resolve any issues arising |
| Used for: | 1130 (map 3) |
| Year: | Interpolated 2012 |
| Title: | Intertidal and subtidal surveys, 2010 |
| GIS operations: | Polygon feature classes from marine community types base data sub-divided based on interpolation of marine survey data. Expert opinion used as necessary to resolve any issues arising |
| Used for: | Marine community types, 1140 (maps 4 and 5) |
| Year: | 2005 |
| Title: | OSi Discovery series vector data |
| GIS operations: | High water mark (HWM) and low water mark (LWM) polyline feature classes converted into polygon feature classes and combined; EU Annex I Saltmarsh and Coastal data erased out if present |
| Used for: | Marine community types base data (map 5) |
| Year: | Revision 2010 |
| Title: | Saltmarsh Monitoring Project 2007-2008. Version 1 |
| GIS operations: | QIs selected; clipped to SAC boundary; overlapping regions with Coastal CO data investigated and resolved with expert opinion used |
| Used for: | 1310, 1330 (map 6) |
| Year: | 2009 |
| Title: | Coastal Monitoring Project 2004-2006. Version 1 |
| GIS operations: | QIs selected; clipped to SAC boundary; overlapping regions with Saltmarsh CO data investigated and resolved with expert opinion used |
| Used for: | 2110, 2120, 2130 (map 7) |

1130 Estuaries

To maintain the favourable conservation condition of Estuaries in Boyne Coast and Estuary SAC, which is defined by the following list of attributes and targets:

| Attribute | Measure | Target | Notes |
|------------------------|----------|---|---|
| Habitat area | Hectares | The permanent habitat area is stable or increasing, subject to natural processes. See map 3 | Habitat area was estimated as 403ha using OSi data and the defined Transitional Water Body area under the Water Framework Directive |
| Community distribution | Hectares | Conserve the following community types in a natural condition: Intertidal estuarine mud and fine sand with <i>Hediste diversicolor</i> and <i>Corophium volutator</i> community; and Subtidal fine sand dominated by polychaetes community. See map 5 | Habitat structure was elucidated from intertidal and subtidal surveys undertaken in 2010 (ASU, 2011; EcoServe, 2011) |

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1140 Mudflats and sandflats not covered by seawater at low tide

To maintain the favourable conservation condition of Mudflats and sandflats not covered by seawater at low tide in Boyne Coast and Estuary SAC, which is defined by the following list of attributes and targets:

| Attribute | Measure | Target | Notes |
|------------------------|----------|---|---|
| Habitat area | Hectares | The permanent habitat area is stable or increasing, subject to natural processes. See map 4 | Habitat area was estimated using OSi data as 403ha |
| Community distribution | Hectares | Conserve the following community types in a natural condition: Intertidal estuarine mud and fine sand with <i>Hediste diversicolor</i> and <i>Corophium volutator</i> community; and Fine sand dominated by bivalves community complex. See map 5 | Habitat structure was elucidated from an intertidal survey undertaken in 2010 (ASU, 2011). See marine supporting document for further details |

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Conservation objectives for: Boyne Coast and Estuary SAC [001957]

1310 Salicornia and other annuals colonizing mud and sand

To restore the favourable conservation condition of *Salicornia* and other annuals colonizing mud and sand in Boyne Coast and Estuary SAC, which is defined by the following list of attributes and targets:

| Attribute | Measure | Target | Notes |
|---|--|---|--|
| Habitat area | Hectares | Area stable or increasing, subject to natural processes, including erosion and succession. For sub-sites mapped: Baltray- 2.91ha, Mornington- 1.14ha. See map 6 | Based on data from Saltmarsh Monitoring Project (McCorry and Ryle, 2009). Habitat mapped at two sub-sites surveyed, giving a total estimated area of 4.05ha. NB further unsurveyed areas maybe present within the site. See coastal habitats supporting document for further details |
| Habitat distribution | Occurrence | No decline or change in habitat distribution, subject to natural processes. See map 6 for known distribution | Based on data from McCorry and Ryle (2009). <i>Salicornia</i> is an annual species, so its distribution can vary significantly from year to year. At Baltray, saltmarsh is expanding in infilled intertidal zone. Large area of Mornington saltmarsh was reclaimed in the past. See coastal habitats supporting document for further details |
| Physical structure: sediment supply | Presence/ absence of physical barriers | Maintain/restore natural circulation of sediments and organic matter, without any physical obstructions | Based on data from McCorry and Ryle (2009). Sediment supply is particularly important for this pioneer saltmarsh community, as the distribution of this habitat depends on accretion rates. Sediment supply to saltmarshes at Baltray and Mornington is likely to be affected by the construction of navigation walls and dredging of the main channel. See coastal habitats supporting document for further details |
| Physical structure: creeks and pans | Occurrence | Maintain creek and pan structure, subject to natural processes, including erosion and succession | Based on data from McCorry and Ryle (2009). Creeks deliver sediment throughout saltmarsh system. At Baltray and Mornington the structure is modified by drainage channels. See coastal habitats supporting document for further details |
| Physical structure: flooding regime | Hectares flooded; frequency | Maintain natural tidal regime | This pioneer saltmarsh community requires regular tidal inundation. See coastal habitats supporting document for further details |
| Vegetation structure: zonation | Occurrence | Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession | Based on data from McCorry and Ryle (2009). At Baltray and Mornington there are zonations within the saltmarsh habitats as well as transitions to adjacent sand dune systems. See coastal habitats supporting document for further details |
| Vegetation structure: vegetation height | Centimeters | Maintain structural variation within sward | Based on data from McCorry and Ryle (2009). At Baltray and Mornington grazing is absent and sward height is variable. See coastal habitats supporting document for further details |

Conservation objectives for: Boyne Coast and Estuary SAC [001957]

1310 Salicornia and other annuals colonizing mud and sand

To restore the favourable conservation condition of *Salicornia* and other annuals colonizing mud and sand in Boyne Coast and Estuary SAC, which is defined by the following list of attributes and targets:

| Attribute | Measure | Target | Notes |
|---|---|--|--|
| Vegetation structure: vegetation cover | Percentage cover at a representative sample of monitoring stops | Maintain more than 90% of area outside creeks vegetated | Based on data from McCorry and Ryle (2009). See coastal habitats supporting document for further details |
| Vegetation composition: typical species and sub-communities | Percentage cover | Maintain the presence of species-poor communities with typical species listed in the Saltmarsh Monitoring Project (McCorry and Ryle, 2009) | Based on data from McCorry & Ryle (2009). See coastal habitats supporting document for further details |
| Vegetation structure: negative indicator species- <i>Spartina anglica</i> | Hectares | No significant expansion of common cordgrass (<i>Spartina anglica</i>), with an annual spread of less than 1% | Based on data from McCorry & Ryle (2009). <i>Spartina</i> is well established at this site. Swards of <i>Spartina</i> are widespread at Baltray and there has been significant expansion of <i>Spartina</i> at Mornington since 2000. See coastal habitats supporting document for further details |

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Conservation objectives for: Boyne Coast and Estuary SAC [001957]

1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)

To maintain the favourable conservation condition of Atlantic salt meadows (*Glauco-Puccinellietalia*) in Boyne Coast and Estuary SAC, which is defined by the following list of attributes and targets:

| Attribute | Measure | Target | Notes |
|---|---|--|---|
| Habitat area | Hectares | Area stable or increasing, subject to natural processes, including erosion and succession. For sub-sites mapped: Baltray- 17.67ha, Mornington- 8.76ha. See map 6 | Based on data from the Saltmarsh Monitoring Project (McCorry and Ryle, 2009). Habitat mapped at two sub-sites surveyed, giving a total estimated area of 26.43ha. NB further unsurveyed areas maybe present within the site. See coastal habitats supporting document for further details |
| Habitat distribution | Occurrence | No decline or change in habitat distribution, subject to natural processes. See map 6 for known distribution | Based on data from McCorry and Ryle (2009). At Baltray there has been some extensive recent development of ASM. At Mornington the saltmarsh may have been more extensive in the past. See coastal habitats supporting document for further details |
| Physical structure: sediment supply | Presence/ absence of physical barriers | Maintain natural circulation of sediments and organic matter, without any physical obstructions | Based on data from McCorry and Ryle (2009). At Baltray and Mornington saltmarsh development likely to be affected by the construction of navigation walls in the past and dredging of the main channel. See coastal habitats supporting document for further details |
| Physical structure: creeks and pans | Occurrence | Maintain creek and pan structure, subject to natural processes, including erosion and succession | Based on data from McCorry and Ryle (2009). Creek and pan structures are well-developed in some parts of Baltray and Mornington but modified in other areas by drainage channels. See coastal habitats supporting document for further details |
| Physical structure: flooding regime | Hectares flooded; frequency | Maintain natural tidal regime | See coastal habitats supporting document for further details |
| Vegetation structure: zonation | Occurrence | Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession | Based on data from McCorry and Ryle (2009). At Baltray and Mornington there are zonations within the saltmarsh habitats as well as transitions to adjacent sand dune systems. See coastal habitats supporting document for further details |
| Vegetation structure: vegetation height | Centimeters | Maintain structural variation within sward | Based on data from McCorry and Ryle (2009). The saltmarshes at Baltray and Mornington are ungrazed by livestock and the sward height is quite variable. See coastal habitats supporting document for further details |
| Vegetation structure: vegetation cover | Percentage cover at a representative sample of monitoring stops | Maintain more than 90% of area outside creeks vegetated | See coastal habitats supporting document for further details |

1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)

To maintain the favourable conservation condition of Atlantic salt meadows (*Glauco-Puccinellietalia*) in Boyne Coast and Estuary SAC, which is defined by the following list of attributes and targets:

| Attribute | Measure | Target | Notes |
|--|---|--|--|
| Vegetation composition: typical species and sub-communities | Percentage cover at a representative sample of monitoring stops | Maintain range of sub-communities with typical species listed in Saltmarsh Monitoring Project (McCorry and Ryle, 2009) | See coastal habitats supporting document for further details |
| Vegetation structure: negative indicator species - <i>Spartina anglica</i> | Hectares | No significant expansion of common cordgrass (<i>Spartina anglica</i>), with an annual spread of less than 1% | Based on data from McCorry and Ryle (2009). <i>Spartina</i> is well established at this site. Swards of <i>Spartina</i> are widespread at Baltray and there has been significant expansion of <i>Spartina</i> at Mornington since 2000. See coastal habitats supporting document for further details |

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Conservation objectives for: Boyne Coast and Estuary SAC [001957]

1410 Mediterranean salt meadows (*Juncetalia maritimi*)

The status of Mediterranean salt meadows (*Juncetalia maritimi*) as a qualifying Annex I habitat for Boyne Coast and Estuary SAC is currently under review. The outcome of this review will determine whether a site-specific conservation objective is set for this habitat.

| Attribute | Measure | Target | Notes |
|-----------|---------|--------|-------|
| | | | |

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2110 Embryonic shifting dunes

To restore the favourable conservation condition of Embryonic shifting dunes in Boyne Coast and Estuary SAC, which is defined by the following list of attributes and targets:

| Attribute | Measure | Target | Notes |
|---|--|---|--|
| Habitat area | Hectares | Area stable or increasing, subject to natural processes, including erosion and succession. For sub-sites mapped: Baltray- 2.52ha, Mornington- 0.67ha. See map 7 | Based on data from the Coastal Monitoring Project (Ryle et al., 2009). Habitat is very difficult to measure in view of its dynamic nature and was recorded at both sub-sites, giving a total estimated area of 3.18ha. See coastal habitats supporting document for further details |
| Habitat distribution | Occurrence | No decline or change in habitat distribution, subject to natural processes. See map 7 for known distribution | Based on data from Ryle et al. (2009). See coastal habitats supporting document for further details |
| Physical structure: functionality and sediment supply | Presence/ absence of physical barriers | Maintain the natural circulation of sediment and organic matter, without any physical obstructions | Based on data from Ryle et al. (2009). Dunes are naturally dynamic systems that require continuous supply and circulation of sand. The training wall at the mouth of the Boyne Estuary has led to an accumulation of sand at Mornington and enhanced the development of dunes at the northern section. The dunes are accreting at the southern end of Baltray, with wide areas of embryonic dune and strandine fronting mobile and fixed dunes. See coastal habitats supporting document for further details |
| Vegetation structure: zonation | Occurrence | Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession | Based on data from Ryle et al. (2009). Both sand dune systems at Baltray and Mornington occur adjacent to extensive estuarine saltmarshes. See coastal habitats supporting document for further details |
| Vegetation composition: plant health of foredune grasses | Percentage cover | More than 95% of sand couch (<i>Elytrigia juncea</i>) and/or lyme-grass (<i>Leymus arenarius</i>) should be healthy (i.e. green plant parts above ground and flowering heads present) | Based on data from Ryle et al. (2009). See coastal habitats supporting document for further details |
| Vegetation composition: typical species and sub-communities | Percentage cover | Maintain the presence of species-poor communities with typical species: sand couch (<i>Elytrigia juncea</i>) and/or lyme-grass (<i>Leymus arenarius</i>) | Based on data from Ryle et al. (2009). See coastal habitats supporting document for further details |

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2110 Embryonic shifting dunes

To restore the favourable conservation condition of Embryonic shifting dunes in Boyne Coast and Estuary SAC, which is defined by the following list of attributes and targets:

| Attribute | Measure | Target | Notes |
|--|------------------|--|--|
| Vegetation composition: negative indicator species | Percentage cover | Negative indicator species (including non-natives) to represent less than 5% cover | Based on data from Ryle et al. (2009). Negative indicators include non-native species, species indicative of changes in nutrient status and species not considered characteristic of the habitat. Sea buckthorn (<i>Hippophae rhamnoides</i>) should be absent or effectively controlled. See coastal habitats supporting document for further details |

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2120 Shifting dunes along the shoreline with *Ammophila arenaria* ('white dunes')

To restore the favourable conservation condition of Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) in Boyne Coast and Estuary SAC, which is defined by the following list of attributes and targets:

| Attribute | Measure | Target | Notes |
|---|---|---|---|
| Habitat area | Hectares | Area stable or increasing, subject to natural processes including erosion and succession. For sub-sites mapped: Baltray- 2.97ha, Mornington- 1.99ha. See map 7 | Habitat was mapped during the Coastal Monitoring Project (Ryle et al. 2009). Habitat was recorded at both sub-sites, giving a total estimated area of 4.97ha. Habitat is very difficult to measure in view of its dynamic nature. See coastal habitats supporting document for further details |
| Habitat distribution | Occurrence | No decline or change in habitat distribution, subject to natural processes. See map 7 for known distribution | Based on data from Ryle et al. (2009). Shifting dunes were recorded at both Baltray and Mornington sub-sites. See coastal habitats supporting document for further details |
| Physical structure: functionality and sediment supply | Presence/ absence of physical barriers | Maintain the natural circulation of sediment and organic matter, without any physical obstructions | Dunes are naturally dynamic systems that require continuous supply and circulation of sand. Marram (<i>Ammophila arenaria</i>) reproduces vegetatively and requires constant accretion of fresh sand to maintain active growth encouraging further accretion. The training wall at the mouth of the Boyne Estuary has led to an accumulation of sand at Mornington and enhanced the development of dunes at the northern section. The dunes are accreting at the southern end of Baltray, with wide areas of embryonic dune and strandine fronting mobile and fixed dunes. See coastal habitats supporting document for further details |
| Vegetation structure: zonation | Occurrence | Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession | Based on data from Gaynor (2008) and Ryle et al. (2009). Both sand dune systems at Baltray and Mornington occur adjacent to extensive estuarine saltmarshes. See coastal habitats supporting document for further details |
| Vegetation composition: plant health of dune grasses | Percentage cover | More than 95% of marram (<i>Ammophila arenaria</i>) and/or lyme-grass (<i>Leymus arenarius</i>) should be healthy (i.e. green plant parts above ground and flowering heads present) | Based on data from Ryle et al. (2009). See coastal habitats supporting document for further details |
| Vegetation composition: typical species and sub-communities | Percentage cover at a representative number of monitoring stops | Maintain the presence of species-poor communities dominated by marram (<i>Ammophila arenaria</i>) and/or lyme-grass (<i>Leymus arenarius</i>) | Based on data from Ryle et al. (2009). See coastal habitats supporting document for further details |

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2120 Shifting dunes along the shoreline with *Ammophila arenaria* ('white dunes')

To restore the favourable conservation condition of Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) in Boyne Coast and Estuary SAC, which is defined by the following list of attributes and targets:

| Attribute | Measure | Target | Notes |
|--|------------------|--|---|
| Vegetation composition: negative indicator species | Percentage cover | Negative indicator species (including non-natives) to represent less than 5% cover | Based on data from Ryle et al. (2009). Negative indicators include non-native species, species indicative of changes in nutrient status and species not considered characteristic of the habitat. Sea buckthorn (<i>Hippophae rhamnoides</i>) should be absent or effectively controlled. Ragwort (<i>Senecio jacobaea</i>) was recorded from Mobile dunes at both Baltray and Mornington. See coastal habitats supporting document for further details |

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2130 *Fixed coastal dunes with herbaceous vegetation ('grey dunes')

To restore the favourable conservation condition of Fixed coastal dunes with herbaceous vegetation (grey dunes) in Boyne Coast and Estuary SAC, which is defined by the following list of attributes and targets:

| Attribute | Measure | Target | Notes |
|---|---|--|--|
| Habitat area | Hectares | Area increasing, subject to natural processes including erosion and succession. For sub-sites mapped: Baltray-26.41ha; Mornington-20.46ha. See map 7 | Based on data from the Coastal Monitoring Project (Ryle et al., 2009). Habitat was recorded at both sub-sites, giving a total estimated area of 46.87ha. See coastal habitats supporting document for further details |
| Habitat distribution | Occurrence | No decline or change in habitat distribution, subject to natural processes. See map 7 for known distribution | Based on data from the Coastal Monitoring Project (Ryle et al., 2009). Fixed dunes recorded at both Baltray and Mornington. See coastal habitats supporting document for further details |
| Physical structure: functionality and sediment supply | Presence/ absence of physical barriers. | Maintain the natural circulation of sediment and organic matter, without any physical obstructions | Based on data from the Coastal Monitoring Project (Ryle et al., 2009). The training wall at the mouth of the Boyne Estuary has led to an accumulation of sand at Mornington and enhanced the development of dunes at the northern section. The dunes are accreting at the southern end of Baltray, with wide areas of embryonic dune and strandine fronting mobile and fixed dunes. See coastal habitats supporting document for further details |
| Vegetation structure: zonation | Occurrence | Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession | Based on data from Ryle et al. (2009). Both sand dune systems at Baltray and Mornington occur adjacent to extensive estuarine saltmarshes. See coastal habitats supporting document for further details |
| Vegetation structure: bare ground | Percentage cover | Bare ground should not exceed 10% of fixed dune habitat, subject to natural processes | Based on data from Gaynor (2008) and Ryle et al. (2009). The estimated area of bare sand at Mornington currently accounts for greater than 10% of the fixed dune habitat. See coastal habitats supporting document for further details |
| Vegetation composition: sward height | Centimeters | Maintain structural variation within sward | Based on data from Gaynor (2008) and Ryle et al. (2009). See coastal habitats supporting document for further details |
| Vegetation composition: typical species and sub-communities | Percentage cover at a representative sample of monitoring stops | Maintain range of sub-communities with typical species listed in Ryle et al. (2009) | Based on data from Gaynor (2008) and Ryle et al. (2009). The locally rare species viper's bugloss (<i>Echium vulgare</i>) was recorded in the fixed dunes at Baltray. Mornington is the most northerly known site in Ireland for wild clary (<i>Salvia verbenaca</i>). See coastal habitats supporting document for further details |

2130 *Fixed coastal dunes with herbaceous vegetation ('grey dunes')

To restore the favourable conservation condition of Fixed coastal dunes with herbaceous vegetation (grey dunes) in Boyne Coast and Estuary SAC, which is defined by the following list of attributes and targets:

| Attribute | Measure | Target | Notes |
|--|------------------|--|--|
| Vegetation composition: negative indicator species | Percentage cover | Negative indicator species (including non-natives) to represent less than 5% cover | Based on data from Ryle et al. (2009). Negative indicators include non-native species, species indicative of changes in nutrient status and species not considered characteristic of the habitat. Sea buckthorn (<i>Hippophae rhamnoides</i>) should be absent or effectively controlled. At both Baltray and Mornington, creeping thistle (<i>Cirsium arvense</i>), ragwort (<i>Senecio jacobaea</i>) and common nettle (<i>Urtica dioica</i>) were recorded in fixed dunes. See coastal habitats supporting document for further details |
| Vegetation composition: scrub/trees | Percentage cover | No more than 5% cover or under control | Based on data from Ryle et al. (2009). See coastal habitats supporting document for further details |

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Legend

SAC 001957

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**MAP 1:
BOYNE COAST AND ESTUARY SAC
CONSERVATION OBJECTIVES
SAC DESIGNATION**

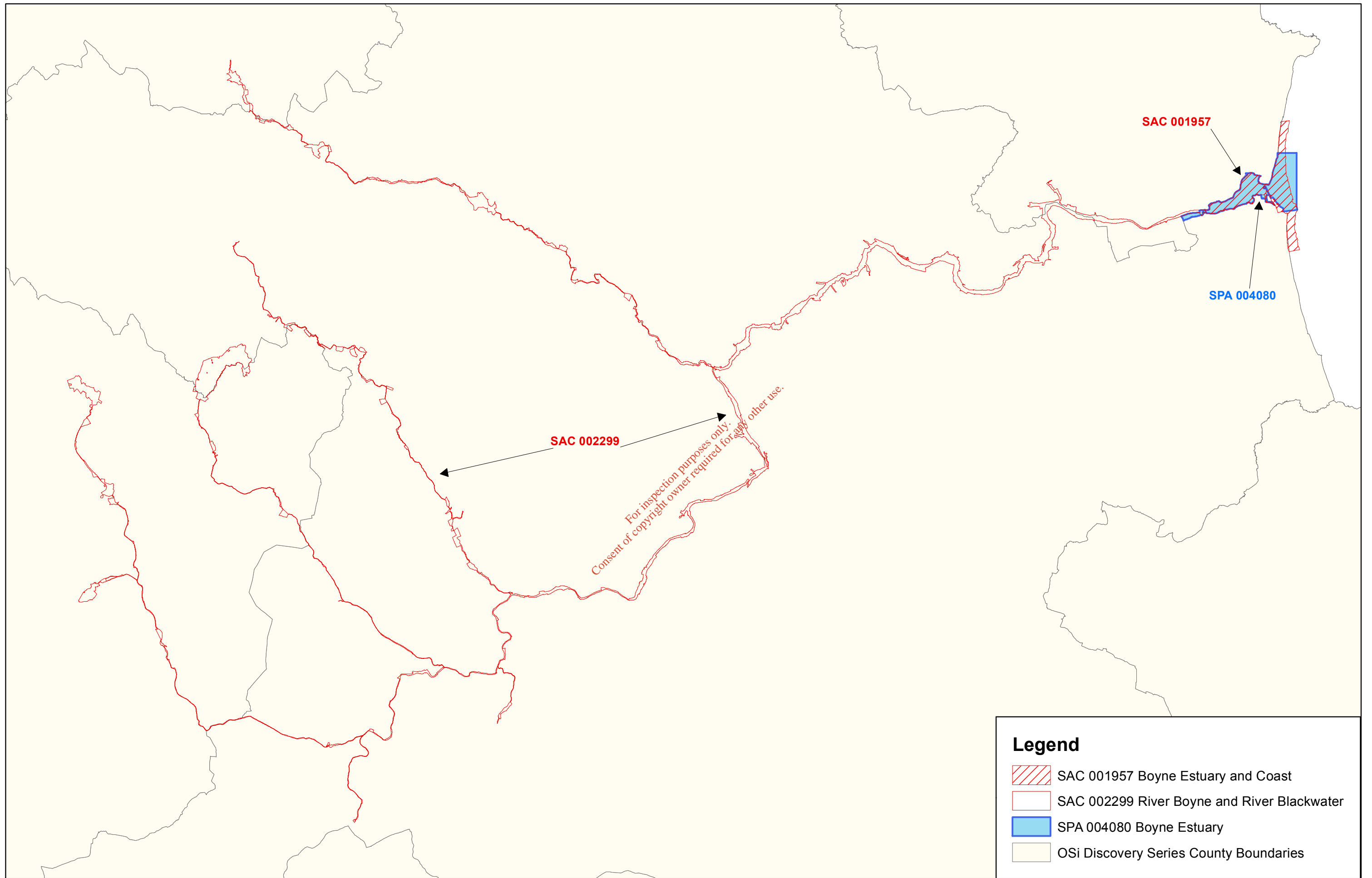
Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE: SAC 001957
CO. LOUTH; version 1.01, CO. MEATH; version 1.06

0 0.5 1 km

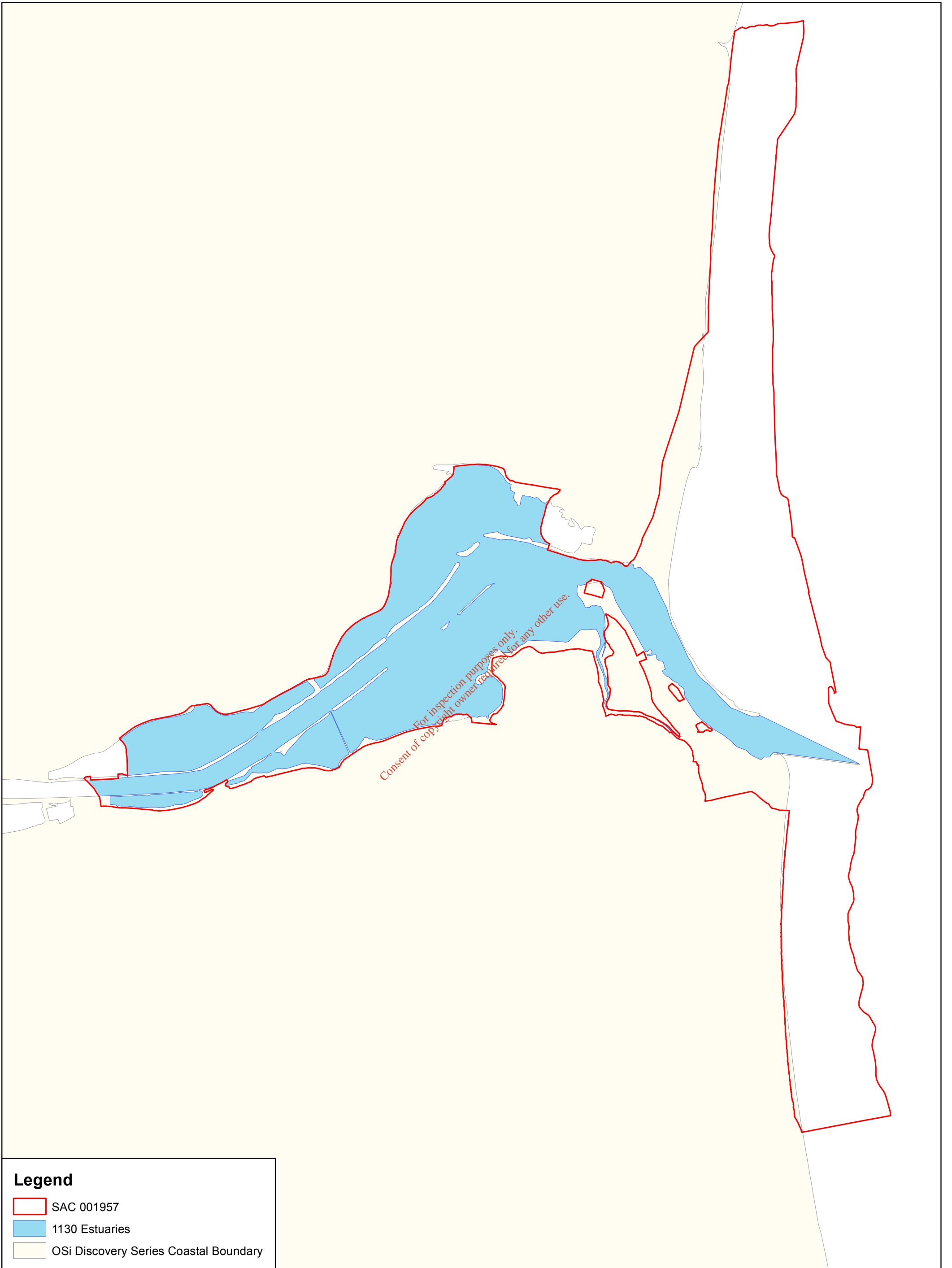
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Níl sna teorainneacha ar na léarscáileanna ach nod garshuíomhach ginearálta. Féadfar athbheithnithe a déanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordonáis le chead ón Rialtas (Ceadúnas Uimh. EN 0059208)

N
Map Version 1
Date: Sept 2012



Legend

- SAC 001957 Boyne Estuary and Coast
- SAC 002299 River Boyne and River Blackwater
- SPA 004080 Boyne Estuary
- OSi Discovery Series County Boundaries



Legend

- SAC 001957
- 1130 Estuaries
- OSi Discovery Series Coastal Boundary

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MAP 3:
BOYNE COAST AND ESTUARY SAC
CONSERVATION OBJECTIVES
ESTUARIES

Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE: SAC 001957
CO.LOUTH; version 1.01, CO. MEATH; version 1.06

0 0.5 1 km

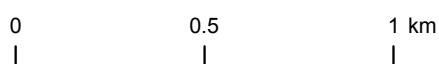
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Níl sna teorainneacha ar na léarscáileanna ach nod garshuíomhach ginearálta. Féadfar athbhreithnithe a déanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordonáis le chead ón Rialtas (Ceadúnas Uimh. EN 0059208)

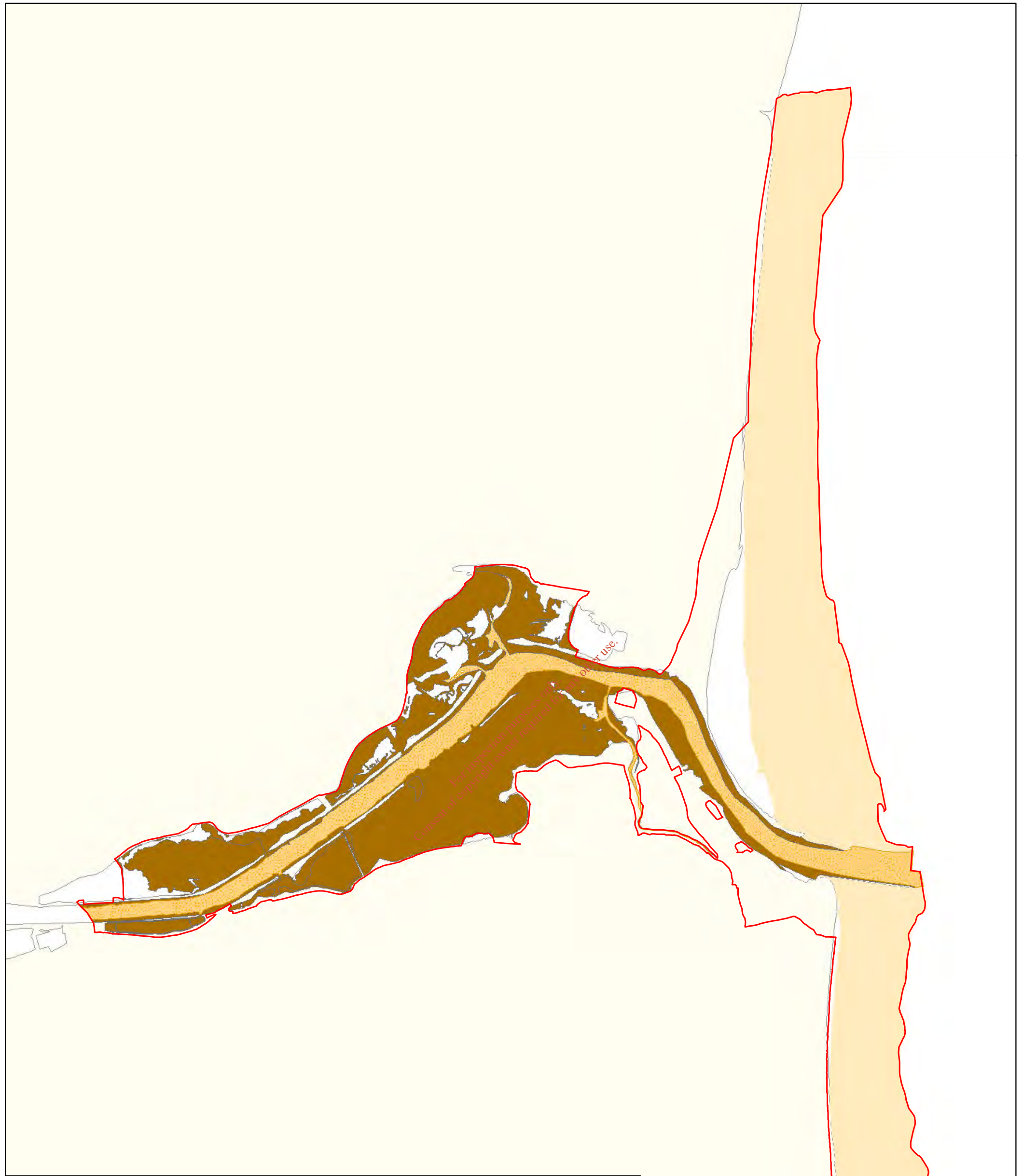
Map Version 1
Date: Sept 2012



Legend

- SAC 001957
- 1140 Mudflats and sandflats not covered by seawater at low tide
- OSi Discovery Series Coastal Boundary



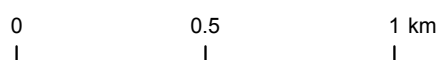


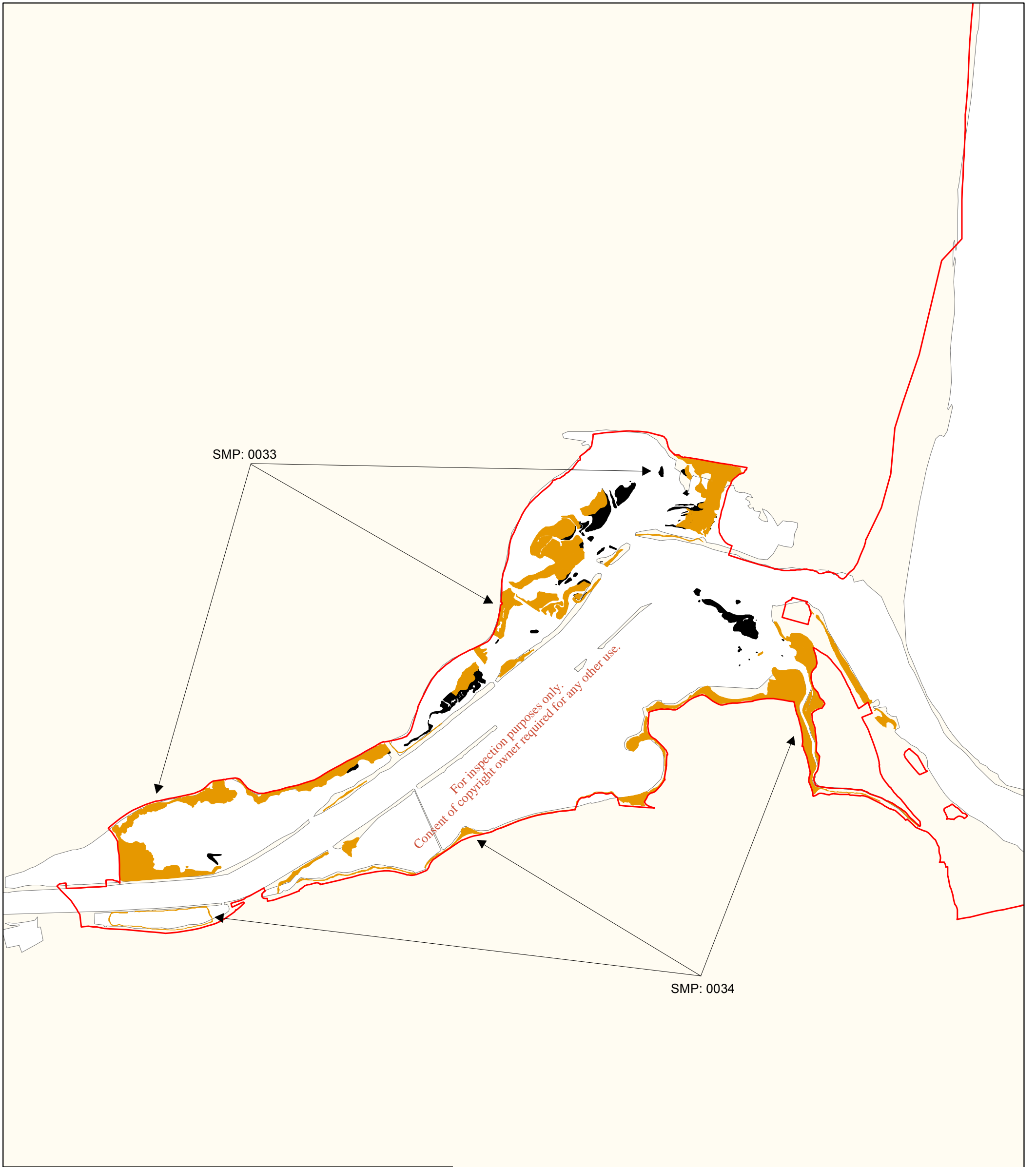
Legend

- SAC 001957
- OSi Discovery Series Coastal Boundary

Marine Community Types

- Fine sand dominated by bivalves community complex
- Intertidal estuarine mud and fine sand with *Hediste diversicolor* and *Corophium volutator* community
- Subtidal fine sand dominated by polychaetes community





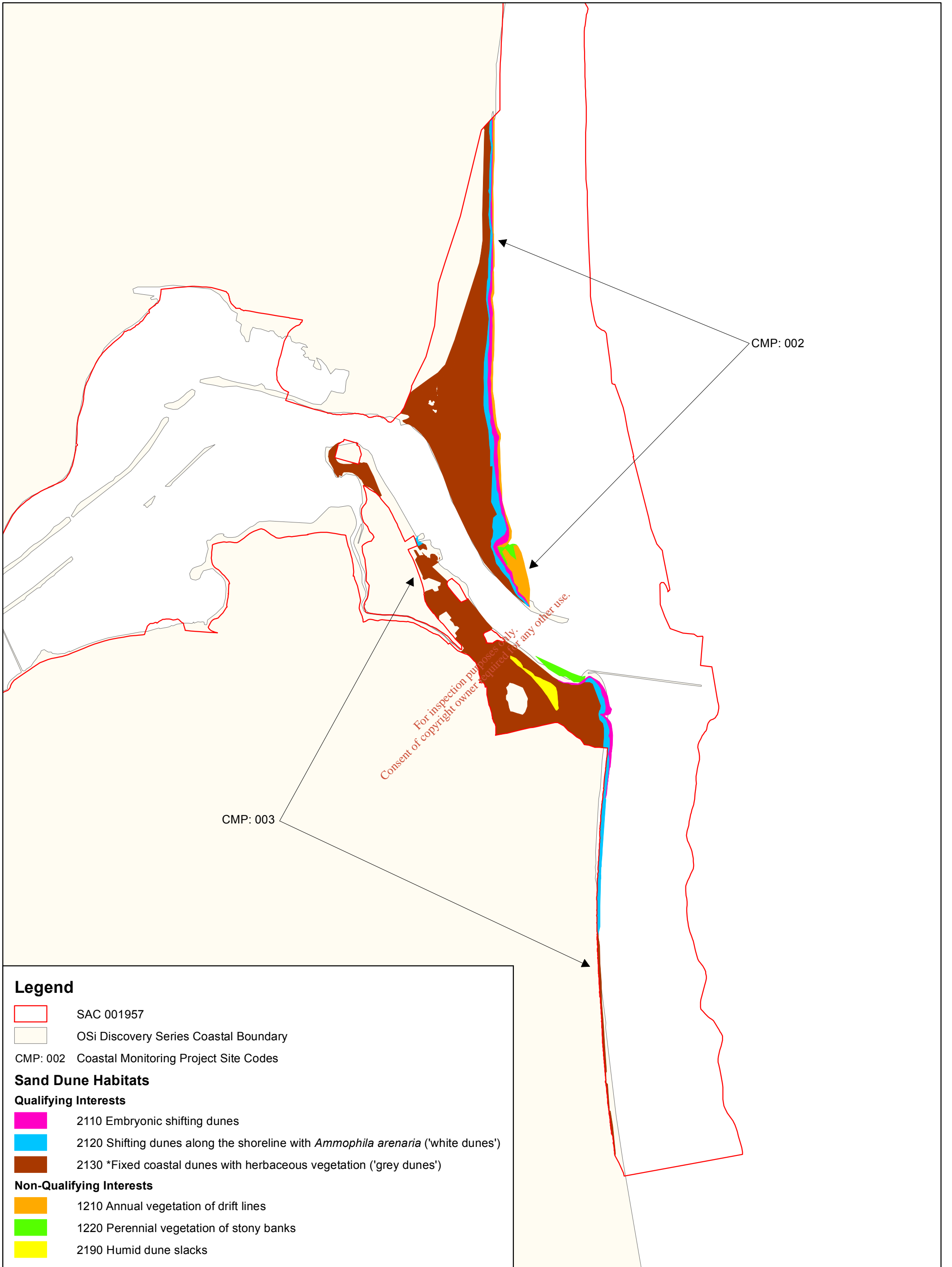
Legend

- SAC 001957
- OSi Discovery Series Coastal Boundary
- SMP: 0033 Saltmarsh Monitoring Project Site Codes

Saltmarsh Habitats

Qualifying Interests

- 1310 *Salicornia* and other annuals colonising mud and sand
- 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritima*)



Legend

- SAC 001957
- OSi Discovery Series Coastal Boundary
- CMP: 002 Coastal Monitoring Project Site Codes

Sand Dune Habitats

Qualifying Interests

- 2110 Embryonic shifting dunes
- 2120 Shifting dunes along the shoreline with *Ammophila arenaria* ('white dunes')
- 2130 *Fixed coastal dunes with herbaceous vegetation ('grey dunes')

Non-Qualifying Interests

- 1210 Annual vegetation of drift lines
- 1220 Perennial vegetation of stony banks
- 2190 Humid dune slacks

Conservation objectives for River Boyne and River Blackwater SAC [002299]

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network.

European and national legislation places a collective obligation on Ireland and its citizens to maintain habitats and species in the Natura 2000 network at favourable conservation condition. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites.

The maintenance of habitats and species within Natura 2000 sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those habitats and species at a national level.

Favourable conservation status of a habitat is achieved when:

- its natural range, and area 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 favourable conservation status of a species is achieved 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.

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:

| Code | Description |
|------|---|
| 7230 | Alkaline fens |
| 91E0 | Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (Alno-Padion, Alnion incanae, Salicion albae)* |

* denotes a priority habitat

| Code | Common Name | Scientific Name |
|------|---------------|-----------------------------|
| 1099 | River Lamprey | <i>Lampetra fluviatilis</i> |
| 1106 | Salmon | <i>Salmo salar</i> |
| 1355 | Otter | <i>Lutra lutra</i> |

Citation: NPWS (2018) Conservation objectives for River Boyne and River Blackwater SAC [002299].
Generic Version 6.0. Department of Culture, Heritage and the Gaeltacht.

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Conservation objectives for River Boyne and River Blackwater SPA [004232]

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network.

European and national legislation places a collective obligation on Ireland and its citizens to maintain habitats and species in the Natura 2000 network at favourable conservation condition. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites.

The maintenance of habitats and species within Natura 2000 sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those habitats and species at a national level.

Favourable conservation status of a habitat is achieved when:

- its natural range, and area 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 favourable conservation status of a species is achieved 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.

Objective: To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA:

| Bird Code | Common Name | Scientific Name |
|-----------|-------------|----------------------|
| A229 | Kingfisher | <i>Alcedo atthis</i> |

Citation: NPWS (2018) Conservation objectives for River Boyne and River Blackwater SPA [004232].
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National Parks and Wildlife Service

Conservation Objectives Series

Boyne Estuary SPA 004080



An Roinn
Ealaíon, Oidhreachta agus Gaeltachta
Department of
Arts, Heritage and the Gaeltacht

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Department of Arts, Heritage and the Gaeltacht,**

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Citation:

**NPWS (2013) Conservation Objectives: Boyne Estuary SPA 004080. Version 1.
National Parks and Wildlife Service, Department of Arts, Heritage and the
Gaeltacht.**

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Series Editor: Rebecca Jeffrey

ISSN 2009-4086

Introduction

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network.

European and national legislation places a collective obligation on Ireland and its citizens to maintain habitats and species in the Natura 2000 network at favourable conservation condition. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites.

A site-specific conservation objective aims to define favourable conservation condition for a particular habitat or species at that site.

The maintenance of habitats and species within Natura 2000 sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those habitats and species at a national level.

Favourable conservation status of a habitat is achieved when:

- its natural range, and area 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 favourable conservation status of a species is achieved 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.

Notes/Guidelines:

1. The targets given in these conservation objectives are based on best available information at the time of writing. As more information becomes available, targets for attributes may change. These will be updated periodically, as necessary.
2. An appropriate assessment based on these conservation objectives will remain valid even if the targets are subsequently updated, providing they were the most recent objectives available when the assessment was carried out. It is essential that the date and version are included when objectives are cited.
3. Assessments cannot consider an attribute in isolation from the others listed for that habitat or species, or for other habitats and species listed for that site. A plan or project with an apparently small impact on one attribute may have a significant impact on another.
4. Please note that the maps included in this document do not necessarily show the entire extent of the habitats and species for which the site is listed. This should be borne in mind when appropriate assessments are being carried out.
5. When using these objectives, it is essential that the relevant backing/supporting documents are consulted, particularly where instructed in the targets or notes for a particular attribute.

Qualifying Interests

* indicates a priority habitat under the Habitats Directive

| | |
|--------|--|
| 004080 | Boyne Estuary SPA |
| A048 | Shelduck <i>Tadorna tadorna</i> |
| A130 | Oystercatcher <i>Haematopus ostralegus</i> |
| A140 | Golden Plover <i>Pluvialis apricaria</i> |
| A141 | Grey Plover <i>Pluvialis squatarola</i> |
| A142 | Lapwing <i>Vanellus vanellus</i> |
| A143 | Knot <i>Calidris canutus</i> |
| A144 | Sanderling <i>Calidris alba</i> |
| A156 | Black-tailed Godwit <i>Limosa limosa</i> |
| A162 | Redshank <i>Tringa totanus</i> |
| A169 | Turnstone <i>Arenaria interpres</i> |
| A195 | Little Tern <i>Sterna albifrons</i> |
| A999 | Wetlands |

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Please note that this SPA overlaps with Boyne Coast and Estuary SAC (001957) and River Boyne and River Blackwater SAC (002299). See map 2. The conservation objectives for this site should be used in conjunction with those for the overlapping SACs as appropriate.

Supporting documents, relevant reports & publications

Supporting documents, NPWS reports and publications are available for download from: www.npws.ie/Publications

| | |
|-----------------|---|
| Year : | 1995 |
| Title : | Seabird monitoring handbook for Britain and Ireland: a compilation of methods for survey and monitoring of breeding seabirds. |
| Author : | Walsh, P.; Halley, D.J.; Harris, M.P.; del Nevo, A.; Sim, I.M.W.; Tasker, M.L. |
| Series : | JNCC, Peterborough |
| Year : | 2004 |
| Title : | Seabird Populations of Britain and Ireland |
| Author : | Mitchell, P.I.; Newton, S.F.; Ratcliffe, N.; Dunn, T.E. |
| Series : | Poyser, London |
| Year : | 2010 |
| Title : | 2010 report for the little tern conservation project at Baltray, Co. Louth |
| Author : | Reilly, M. |
| Series : | Unpublished report by Louth Nature Trust |
| Year : | 2013 |
| Title : | Seabird Monitoring Programme (SMP) Database |
| Author : | JNCC |
| Series : | http://jncc.defra.gov.uk/smp/Default.aspx |
| Year : | 2013 |
| Title : | BirdLife International Seabird Ecology and Foraging Range Database |
| Author : | BirdLife International |
| Series : | http://seabird.wikispaces.com |
| Year : | 2012 |
| Title : | Boyne Estuary SPA (site code 4080) Conservation Objectives Supporting Document V1 |
| Author : | NPWS |
| Series : | Unpublished report to NPWS |

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A048 **Shelduck *Tadorna tadorna***

To maintain the favourable conservation condition of Shelduck in Boyne Estuary SPA, which is defined by the following list of attributes and targets:

| Attribute | Measure | Target | Notes |
|------------------|---|---|---|
| Population trend | Percentage change | Long term population trend stable or increasing | Waterbird population trends are presented in part four of the conservation objectives supporting document |
| Distribution | Range, timing and intensity of use of areas | No significant decrease in the range, timing or intensity of use of areas by shelduck, other than that occurring from natural patterns of variation | Waterbird distribution from the 2011/2012 waterbird survey programme is discussed in part five of the conservation objectives supporting document |

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Conservation Objectives for : Boyne Estuary SPA [004080]

A130 Oystercatcher *Haematopus ostralegus*

To maintain the favourable conservation condition of Oystercatcher in Boyne Estuary SPA, which is defined by the following list of attributes and targets:

| Attribute | Measure | Target | Notes |
|------------------|---|---|---|
| Population trend | Percentage change | Long term population trend stable or increasing | Population trends are presented in part four of the conservation objectives supporting document |
| Distribution | Range, timing and intensity of use of areas | No significant decrease in the range, timing and intensity of use of areas by oystercatcher, other than that occurring from natural patterns of variation | Waterbird distribution from the 2011/2012 waterbird survey programme is discussed in part five of the conservation objectives supporting document |

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Conservation Objectives for : Boyne Estuary SPA [004080]

A140 Golden Plover *Pluvialis apricaria*

To maintain the favourable conservation condition of Golden Plover in Boyne Estuary SPA, which is defined by the following list of attributes and targets:

| Attribute | Measure | Target | Notes |
|------------------|---|--|---|
| Population trend | Percentage change | Long term population trend stable or increasing | Population trends are presented in part four of the conservation objectives supporting document |
| Distribution | Range, timing and intensity of use of areas | No significant decrease in the range, timing or intensity of use of areas by golden plover, other than that occurring from natural patterns of variation | Waterbird distribution from the 2011/2012 waterbird survey programme is discussed in part five of the conservation objectives supporting document |

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Conservation Objectives for : Boyne Estuary SPA [004080]

A141 Grey Plover *Pluvialis squatarola*

To maintain the favourable conservation condition of Grey Plover in Boyne Estuary SPA, which is defined by the following list of attributes and targets:

| Attribute | Measure | Target | Notes |
|------------------|---|--|---|
| Population trend | Percentage change | Long term population trend stable or increasing | Population trends are presented in part four of the conservation objectives supporting document |
| Distribution | Range, timing and intensity of use of areas | No significant decrease in the range, timing or intensity of use of areas by grey plover, other than that occurring from natural patterns of variation | Waterbird distribution from the 2011/2012 waterbird survey programme is discussed in part five of the conservation objectives supporting document |

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Conservation Objectives for : Boyne Estuary SPA [004080]

A142 Lapwing *Vanellus vanellus*

To maintain the favourable conservation condition of Lapwing in Boyne Estuary SPA, which is defined by the following list of attributes and targets:

| Attribute | Measure | Target | Notes |
|------------------|---|--|---|
| Population trend | Percentage change | Long term population trend stable or increasing | Waterbird population trends are presented in part four of the conservation objectives supporting document |
| Distribution | Range, timing and intensity of use of areas | No significant decrease in the range, timing or intensity of use of areas by lapwing, other than that occurring from natural patterns of variation | Waterbird distribution from the 2011/2012 waterbird survey programme is discussed in part five of the conservation objectives supporting document |

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Conservation Objectives for : Boyne Estuary SPA [004080]

A143 Knot *Calidris canutus*

To maintain the favourable conservation condition of Knot in Boyne Estuary SPA, which is defined by the following list of attributes and targets:

| Attribute | Measure | Target | Notes |
|------------------|---|---|---|
| Population trend | Percentage change | Long term population trend stable or increasing | Waterbird population trends are presented in part four of the conservation objectives supporting document |
| Distribution | Range, timing and intensity of use of areas | No significant decrease in the range, timing or intensity of use of areas by knot, other than that occurring from natural patterns of variation | Waterbird distribution from the 2011/2012 waterbird survey programme is discussed in part five of the conservation objectives supporting document |

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Conservation Objectives for : Boyne Estuary SPA [004080]

A144 Sanderling *Calidris alba*

To maintain the favourable conservation condition of Sanderling in Boyne Estuary SPA, which is defined by the following list of attributes and targets:

| Attribute | Measure | Target | Notes |
|------------------|---|---|---|
| Population trend | Percentage change | Long term population trend stable or increasing | Waterbird population trends are presented in part four of the conservation objectives supporting document |
| Distribution | Range, timing and intensity of use of areas | No significant decrease in the range, timing or intensity of use of areas by sanderling, other than that occurring from natural patterns of variation | Waterbird distribution from the 2011/2012 waterbird survey programme is discussed in part five of the conservation objectives supporting document |

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Conservation Objectives for : Boyne Estuary SPA [004080]

A156 Black-tailed Godwit *Limosa limosa*

To maintain the favourable conservation condition of Black-tailed Godwit in Boyne Estuary SPA, which is defined by the following list of attributes and targets:

| Attribute | Measure | Target | Notes |
|------------------|---|--|---|
| Population trend | Percentage change | Long term population trend stable or increasing | Population trends are presented in part four of the conservation objectives supporting document |
| Distribution | Range, timing and intensity of use of areas | No significant decrease in the range, timing or intensity of use of areas by black-tailed godwit, other than that occurring from natural patterns of variation | Waterbird distribution from the 2011/2012 waterbird survey programme is discussed in part five of the conservation objectives supporting document |

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Conservation Objectives for : Boyne Estuary SPA [004080]

A162 Redshank *Tringa totanus*

To maintain the favourable conservation condition of Redshank in Boyne Estuary SPA, which is defined by the following list of attributes and targets:

| Attribute | Measure | Target | Notes |
|------------------|---|---|---|
| Population trend | Percentage change | Long term population trend stable or increasing | Population trends are presented in part four of the conservation objectives supporting document |
| Distribution | Range, timing and intensity of use of areas | No significant decrease in the range, timing or intensity of use of areas by redshank, other than that occurring from natural patterns of variation | Waterbird distribution from the 2011/2012 waterbird survey programme is discussed in part five of the conservation objectives supporting document |

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Conservation Objectives for : Boyne Estuary SPA [004080]

A169 Turnstone *Arenaria interpres*

To maintain the favourable conservation condition of Turnstone in Boyne Estuary SPA, which is defined by the following list of attributes and targets:

| Attribute | Measure | Target | Notes |
|------------------|---|--|---|
| Population trend | Percentage change | Long term population trend stable or increasing | Population trends are presented in part four of the conservation objectives supporting document |
| Distribution | Range, timing and intensity of use of areas | No significant decrease in the range, timing or intensity of use of areas by turnstone, other than that occurring from natural patterns of variation | Waterbird distribution from the 2011/2012 waterbird survey programme is discussed in part five of the conservation objectives supporting document |

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Conservation Objectives for : Boyne Estuary SPA [004080]

A195 Little Tern *Sterna albifrons*

To maintain the favourable conservation condition of Little Tern in Boyne Estuary SPA, which is defined by the following list of attributes and targets:

| Attribute | Measure | Target | Notes |
|---|--|--|---|
| Breeding population abundance: apparently occupied nests (AONs) | Number | No significant decline | Measure based on standard tern survey methods (see Walsh et al., 1995). Mitchell et al. (2004) provides summary population information for Louth. The Seabird Monitoring Programme (SMP) also provides background data (JNCC, 2013). In 2010, 43 breeding pairs were recorded at this colony (Reilly, 2010) |
| Productivity rate: fledged young per breeding pair | Mean number | No significant decline | Measure based on standard tern survey methods (see Walsh et al., 1995). For 2010, an estimated productivity rate of 2.2 fledged birds per breeding pair was reported (Reilly, 2010) |
| Distribution: breeding colonies | Number; location; area (Hectares) | No significant decline | Little tern nest in well-camouflaged shallow scrapes on sand and shingle beaches, spits or inshore islets (Mitchell et al., 2004). For a description of the area used by the colony in 2010, see Reilly (2010) |
| Prey biomass available | Kilogrammes | No significant decline | Key prey items: Mainly small, often juvenile, fish; invertebrates, especially crustaceans and insects. Key habitats: Very shallow water, advancing or receding tidelines, brackish lagoons and saltmarsh creeks, sand-banks close to the coast. Foraging range: Max 11km, mean max 6.94km, mean 4.14km (BirdLife International Seabird Database (Birdlife International, 2013)) |
| Barriers to connectivity | Number; location; shape; area (hectares) | No significant increase | Seabird species can make extensive use of the marine waters adjacent to their breeding colonies. Foraging range: Max 11km, mean max 6.94km, mean 4.14km (BirdLife International Seabird Database (Birdlife International, 2013)) |
| Disturbance at the breeding site | Level of impact | Human activities should occur at levels that do not adversely affect the breeding little tern population | Little tern nest in well-camouflaged shallow scrapes on sand and shingle beaches, spits or inshore islets (Mitchell et al., 2004) |

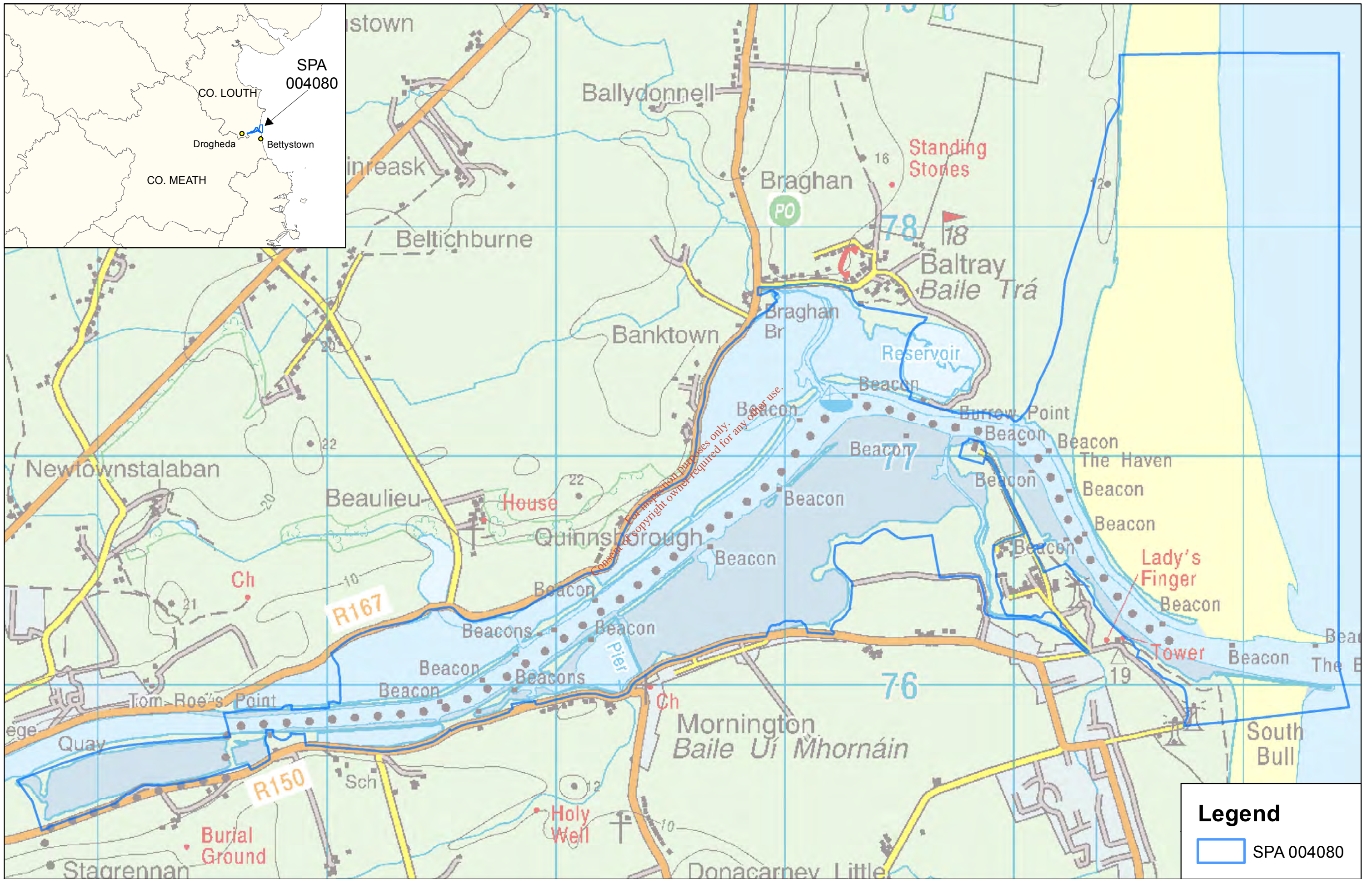
Conservation Objectives for : Boyne Estuary SPA [004080]

A999 Wetlands

To maintain the favourable conservation condition of the wetland habitat in Boyne Estuary SPA as a resource for the regularly-occurring migratory waterbirds that utilise it. This is defined by the following attribute and target:

| Attribute | Measure | Target | Notes |
|--------------|----------|---|---|
| Habitat area | Hectares | The permanent area occupied by the wetland habitat should be stable and not significantly less than the area of 594ha, other than that occurring from natural patterns of variation | The wetland habitat area was estimated as 594ha using OSi data and relevant orthophotographs. For further information see part three of the conservation objectives supporting document |

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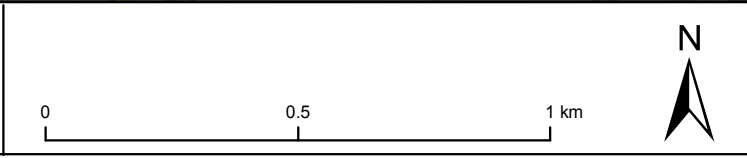


Legend

SPA 004080

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 Department of Arts, Heritage and the Gaeltacht

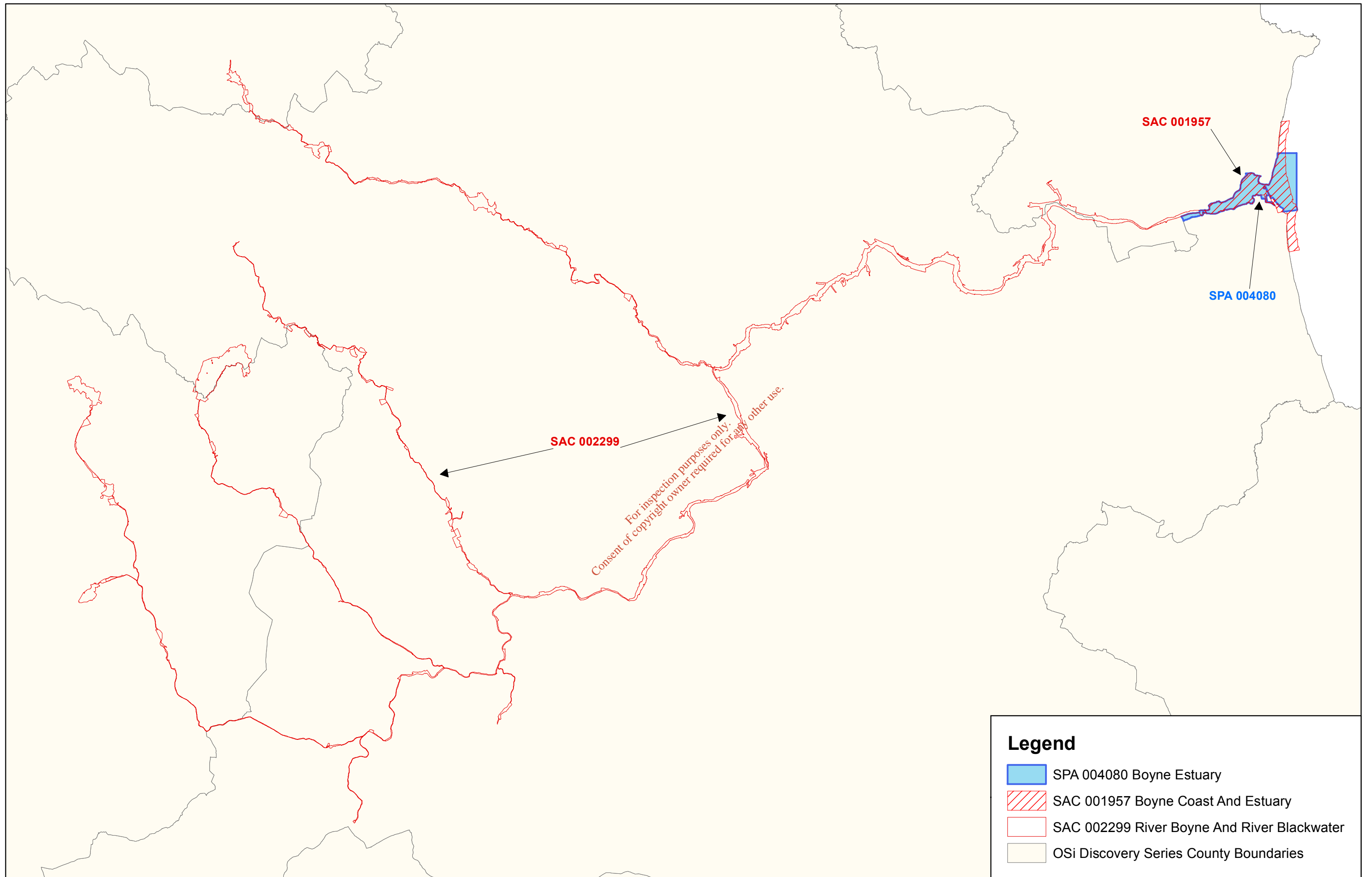
MAP 1:
 BOYNE ESTUARY SPA
 CONSERVATION OBJECTIVES
 SPA DESIGNATION
 Map to be read in conjunction with the NPWS
 Conservation Objectives Document.



Boundaries of designated areas are subject to revision. Reproduced from Ordnance Survey material by permission of the Government (Permit number EN 0059208).

Féadfar athbheithnithe a déanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordonáis le chead ón Rialtas (Ceadúnas Uimh. EN 0059208)

Site Code
 SPA 004080
 Version: 3
 Map Version 1
 Date: September 2012



Legend

- SPA 004080 Boyne Estuary
- SAC 001957 Boyne Coast And Estuary
- SAC 002299 River Boyne And River Blackwater
- OSi Discovery Series County Boundaries

National Parks and Wildlife Service

Conservation Objectives Series

River Nanny Estuary and Shore SPA 004158

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Department of
Arts, Heritage and the Gaeltacht



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E-mail: nature.conservation@ahg.gov.ie**

Citation:

NPWS (2012) Conservation Objectives: River Nanny Estuary and Shore SPA 004158. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

**Series Editors: Rebecca Jeffrey & Naomi Kingston
ISSN 2009-4086**

Introduction

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network.

European and national legislation places a collective obligation on Ireland and its citizens to maintain habitats and species in the Natura 2000 network at favourable conservation condition. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites.

A site-specific conservation objective aims to define favourable conservation condition for a particular habitat or species at that site.

The maintenance of habitats and species within Natura 2000 sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those habitats and species at a national level.

Favourable conservation status of a habitat is achieved when:

- its natural range, and area 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 favourable conservation status of a species is achieved 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.

Notes/Guidelines:

1. The targets given in these conservation objectives are based on best available information at the time of writing. As more information becomes available, targets for attributes may change. These will be updated periodically, as necessary.
2. An appropriate assessment based on these conservation objectives will remain valid even if the targets are subsequently updated, providing they were the most recent objectives available when the assessment was carried out. It is essential that the date and version are included when objectives are cited.
3. Assessments cannot consider an attribute in isolation from the others listed for that habitat or species, or for other habitats and species listed for that site. A plan or project with an apparently small impact on one attribute may have a significant impact on another.
4. Please note that the maps included in this document do not necessarily show the entire extent of the habitats and species for which the site is listed. This should be borne in mind when appropriate assessments are being carried out.
5. When using these objectives, it is essential that the relevant backing/supporting documents are consulted, particularly where instructed in the targets or notes for a particular attribute.

Qualifying Interests

* indicates a priority habitat under the Habitats Directive

004158 River Nanny Estuary and Shore SPA

| | | |
|------|--|-----------|
| A130 | Oystercatcher <i>Haematopus ostralegus</i> | wintering |
| A137 | Ringed Plover <i>Charadrius hiaticula</i> | wintering |
| A140 | Golden Plover <i>Pluvialis apricaria</i> | wintering |
| A143 | Knot <i>Calidris canutus</i> | wintering |
| A144 | Sanderling <i>Calidris alba</i> | wintering |
| A184 | Herring Gull <i>Larus argentatus</i> | wintering |
| A999 | Wetlands | |

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Supporting documents, relevant reports & publications (listed by date)

Supporting documents, NPWS reports and publications are available for download from: www.npws.ie/Publications

Title: River Nanny Estuary and Shore SPA (004158). Conservation objectives supporting document [Version 1]

Year: 2012

Author: NPWS

Series: Unpublished Report to NPWS

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A130 Oystercatcher *Haematopus ostralegus*

To maintain the favourable conservation condition of Oystercatcher in River Nanny Estuary and Shore SPA, which is defined by the following list of attributes and targets:

| Attribute | Measure | Target | Notes |
|------------------|---|---|--|
| Population trend | Percentage change | Long term population trend stable or increasing | Waterbird population trends are presented in part four of the conservation objectives supporting document |
| Distribution | Range, timing and intensity of use of areas | There should be no significant decrease in the range, timing or intensity of use of areas by oystercatcher other than that occurring from natural patterns of variation | As determined by regular low tide and other waterbird surveys. Waterbird distribution from the 2011/2012 waterbird survey programme is discussed in part five of the conservation objectives supporting document |

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A137 Ringed Plover *Charadrius hiaticula*

To maintain the favourable conservation condition of Ringed Plover in River Nanny Estuary and Shore SPA, which is defined by the following list of attributes and targets:

| Attribute | Measure | Target | Notes |
|------------------|---|---|--|
| Population trend | Percentage change | Long term population trend stable or increasing | Waterbird population trends are presented in part four of the conservation objectives supporting document |
| Distribution | Range, timing and intensity of use of areas | There should be no significant decrease in the range, timing or intensity of use of areas by ringed plover other than that occurring from natural patterns of variation | As determined by regular low tide and other waterbird surveys. Waterbird distribution from the 2011/2012 waterbird survey programme is discussed in part five of the conservation objectives supporting document |

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A140 Golden Plover *Pluvialis apricaria*

To maintain the favourable conservation condition of Golden Plover in River Nanny Estuary and Shore SPA, which is defined by the following list of attributes and targets:

| Attribute | Measure | Target | Notes |
|------------------|---|---|--|
| Population trend | Percentage change | Long term population trend stable or increasing | Waterbird population trends are presented in part four of the conservation objectives supporting document |
| Distribution | Range, timing and intensity of use of areas | There should be no significant decrease in the range, timing or intensity of use of areas by golden plover other than that occurring from natural patterns of variation | As determined by regular low tide and other waterbird surveys. Waterbird distribution from the 2011/2012 waterbird survey programme is discussed in part five of the conservation objectives supporting document |

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A143 Knot *Calidris canutus*

To maintain the favourable conservation condition of Knot in River Nanny Estuary and Shore SPA, which is defined by the following list of attributes and targets:

| Attribute | Measure | Target | Notes |
|------------------|---|--|--|
| Population trend | Percentage change | Long term population trend stable or increasing | Waterbird population trends are presented in part four of the conservation objectives supporting document |
| Distribution | Range, timing and intensity of use of areas | There should be no significant decrease in the range, timing or intensity of use of areas by knot other than that occurring from natural patterns of variation | As determined by regular low tide and other waterbird surveys. Waterbird distribution from the 2011/2012 waterbird survey programme is discussed in part five of the conservation objectives supporting document |

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A144 Sanderling *Calidris alba*

To maintain the favourable conservation condition of Sanderling in River Nanny Estuary and Shore SPA, which is defined by the following list of attributes and targets:

| Attribute | Measure | Target | Notes |
|------------------|---|--|--|
| Population trend | Percentage change | Long term population trend stable or increasing | Waterbird population trends are presented in part four of the conservation objectives supporting document |
| Distribution | Range, timing and intensity of use of areas | There should be no significant decrease in the range, timing or intensity of use of areas by sanderling other than that occurring from natural patterns of variation | As determined by regular low tide and other waterbird surveys. Waterbird distribution from the 2011/2012 waterbird survey programme is discussed in part five of the conservation objectives supporting document |

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A184 Herring Gull *Larus argentatus*

To maintain the favourable conservation condition of Herring Gull in River Nanny Estuary and Shore SPA, which is defined by the following list of attributes and targets:

| Attribute | Measure | Target | Notes |
|------------------|---|--|--|
| Population trend | Percentage change | Long term population trend stable or increasing | Waterbird population trends are presented in part four of the conservation objectives supporting document |
| Distribution | Range, timing and intensity of use of areas | There should be no significant decrease in the range, timing or intensity of use of areas by herring gull other than that occurring from natural patterns of variation | As determined by regular low tide and other waterbird surveys. Waterbird distribution from the 2011/2012 waterbird survey programme is discussed in part five of the conservation objectives supporting document |

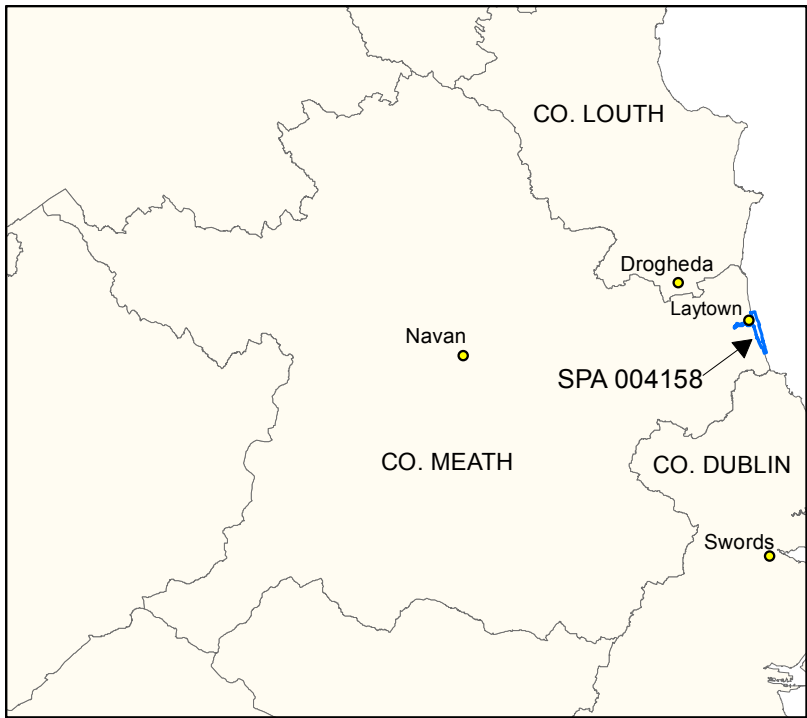
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A999 Wetlands

To maintain the favourable conservation condition of the wetland habitat in River Nanny Estuary and Shore SPA as a resource for the regularly-occurring migratory waterbirds that utilise it. This is defined by the following attribute and target:

| Attribute | Measure | Target | Notes |
|------------------|----------------|---|---|
| Wetland habitat | Area (ha) | The permanent area occupied by the wetland habitat should be stable and not significantly less than the area of 230ha, other than that occurring from natural patterns of variation | The wetland habitat area was estimated as 230ha using OSi data and relevant orthophotographs. For further information see part three of the conservation objectives supporting document |

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Legend

 SPA 004158

Appendix 2

Aquatic Survey Report

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Knockharley Landfill Aquatic Survey

Report 2019



Prepared by Triturus Environmental Ltd. for Fehily Timoney & Company

October 2019

Please cite as:

Triturus (2019) Continuation of aquatic surveys and monitoring of watercourses in the vicinity of Knockharley landfill, Co. Meath

Authors

Ross Macklin is an aquatic ecologist specialising in freshwater and fisheries ecology. He studied a Bachelors Degree in Environmental Science at UCC and later completed diplomas in Geographical Information Systems and Integrated Pest Management. He is currently completing his PhD in UCC in the area of fisheries ecology. Ross has an in-depth knowledge of all freshwater ecosystems and riparian corridors. He has undertaken river habitat, lake habitat, wetland habitat and fisheries assessments in professional work for 14 years. His specialist freshwater experience lies in biological and physiochemical water quality analysis, fisheries ecology, riparian habitat assessments, habitat mapping, protected species, geographical information systems, ecological design and invasive species. Ross has expert experience in identifying and assessing macrophyte plants, terrestrial plants, fish and macro-invertebrates from a variety of aquatic habitats. He routinely undertakes Natura Impact Screening, Natura Impact Statements, Pollution Audits, Fisheries Assessments, Protected Species Surveys, Invasive Species Surveys, Habitat & Surface Water Management Plans, CEMP, EcIA and EIAR reporting.

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1. Introduction

1.1 Project background

Triturus Environmental Ltd. were contracted by Fehily Timoney and Company (FTCO) to continue aquatic monitoring along several watercourses in the vicinity of Knockharley Landfill, Kentstown, Navan, Co. Meath.

The surveys were undertaken to update the existing survey data used in the preparation of the Environmental Impact Assessment Report (EIAR) for the proposed development. A full description of the proposed works is described in chapter 2 of the EIAR. Four watercourses in the vicinity of the landfill were surveyed, namely, the Flemingstown (Knockharley) Stream, Kentstown Stream, Veldonstown Stream and River Nanny as shown in Figure 1.1 and are also referred to as the study area. These watercourses have downstream connectivity with the River Nanny Estuary and Shore SPA (site code: 004158) via the River Nanny, a site designated for overwintering birds and wetlands habitat (NPWS, 2012).

The purpose of this report was to continue the monitoring of aquatic ecology data for watercourses in the vicinity of the landfill through both desktop reviews and walkover surveys. This would help identify and evaluate the overall fisheries and aquatic value of the watercourses within the vicinity of the landfill site.

The survey was focused on aquatic habitats in relation to fisheries potential (including both salmonid and lamprey species), macro-invertebrates, water quality, macrophytes, aquatic invasive species, and Annex II aquatic species which may use the site and its surrounds.

In order to update the existing data for the proposed development and further assess the potential fisheries value of the relevant watercourses in the vicinity of Knockharley Landfill, an electro-fishing survey across $n=6$ sites was undertaken (see Figure 2.1 below). The electro-fishing survey were used to identify the fisheries value of watercourses in the vicinity of Knockharley Landfill.

Triturus Environmental Ltd. made an application under Section 14 of the Fisheries (Consolidation) Act, 1959 as substituted by Section 4 of the Fisheries (Amendment) Act, 1962, to undertake an electrofishing survey on the watercourses in the vicinity of Knockharley Landfill, Co. Meath. Permission was granted on Tuesday 2nd July 2019 and the survey was undertaken on Thursday 22nd August 2019.

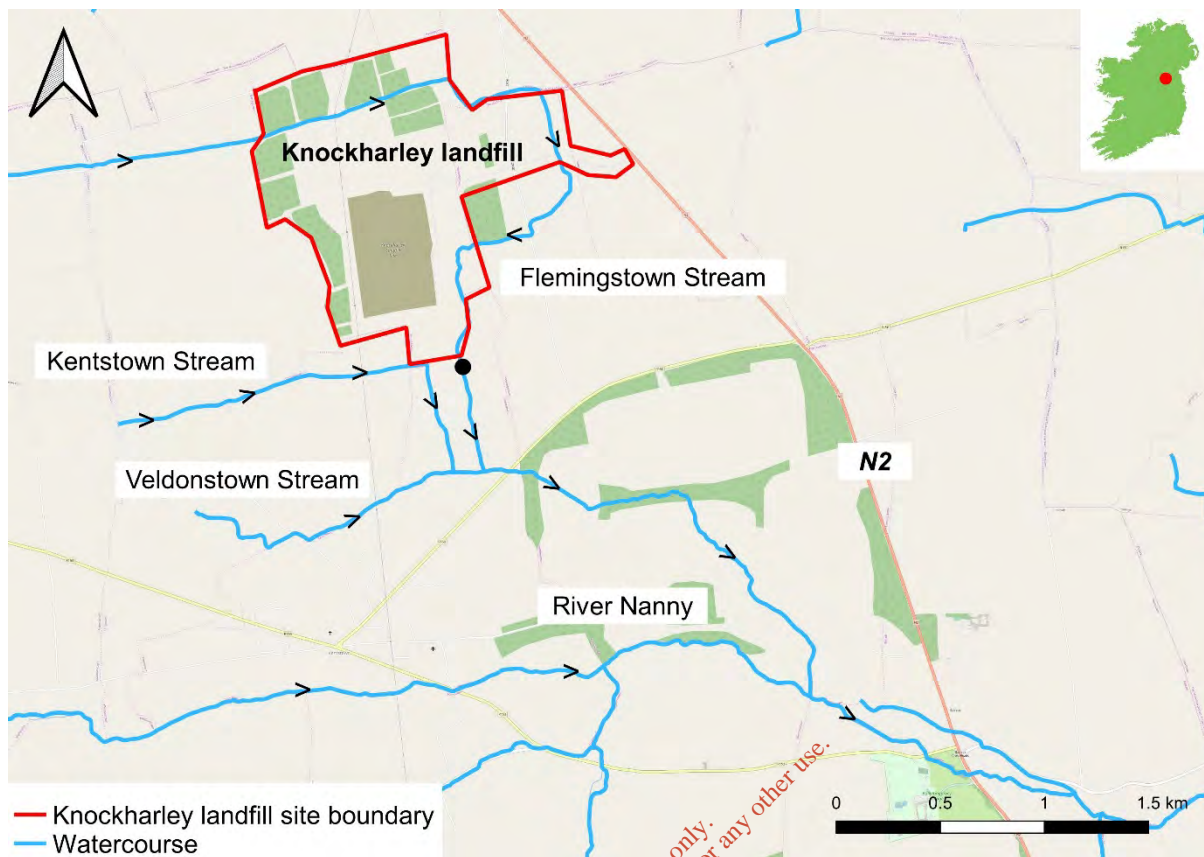


Figure 1.1 Location of the watercourses within the vicinity of Knockharley Landfill (flow direction shown with arrows).

1.2 Fisheries asset of streams in the vicinity of Knockharley Landfill Study Area

Knockharley Landfill and those watercourses in its vicinity (namely the Flemingstown (Knockharley) Stream, Kentstown Stream and Veldonstown Stream) are located within the wider Nanny-Delvin catchment (Figure 1.1). The Nanny River flows east from Kentstown, after which it is joined from the south by the River Hurley, which drains the area north of Ashbourne. The Nanny continues east through Duleek before flowing into the Irish Sea at Laytown, adjoining the River Nanny Estuary and Shore SPA (site code 004158). The Nanny channel was subject to historical arterial drainage at various locations, mostly in 1998 (EPA, 2018a).

Limited fisheries data was available for the smaller streams within the study area. However, the lower reaches of the River Nanny at Julianstown Bridge is known to support brown trout (*Salmo trutta*), minnow (*Phoxinus phoxinus*), European eel (*Anguilla anguilla*), stone loach (*Barbatula barbatula*), flounder (*Platichthys flesus*), European eel and three-spined stickleback (*Gasterosteus aculeatus*) (Kelly et al., 2013). The Nanny also maintains a run of Atlantic salmon (*Salmo salar*) and, in the lower

reaches, sea trout. The river has been recognised as both a recreational sea trout and wild brown trout fishery, particularly in the lower reaches (O’Reilly, 2009).

1.3 Water Quality in the Knockharley Study Area

Routine biological water quality monitoring was carried out at the Knockharley Landfill site for the years 2007-2018. A total of $n=4$ sites were monitored historically between 2007 and 2018 in the vicinity of the landfill (Figure 1.2 below). Two additional sampling sites were added in 2019 (sites 5 and 6) on the Kentstown and Veldonstown Streams respectively to obtain additional data on watercourses situated south and south west of the landfill. These sampling sites would also act as further upstream control sites to compare with water quality data downstream of the confluence with the Flemingstown (Knockharley) Stream that receives a licensed discharge from the existing landfill site. A summary of the location $n=6$ survey locations is also provided on Table 1.2 below. A summary of historical water quality data is provided in the accompanying EIA report. A summary of EPA water quality monitoring is provided in the preceding paragraphs.



Figure 1.2 Location of the $n=6$ survey sites in the vicinity of the landfill.

Table 1.1 Location of $n=6$ electro-fishing and Q-sampling survey sites in the vicinity of Knockharley landfill.

| Site no. | Watercourse & location | X (ITM) | Y (ITM) |
|----------|--|---------|---------|
| 1 | Flemingstown (Knockharley) Stream, Kentstown | 697689 | 766175 |
| 2 | Flemingstown (Knockharley) Stream, Curraghtown | 696053 | 767498 |
| 3 | River Nanny, R153 bridge, Balrath Cross roads | 699872 | 764722 |
| 4 | River Nanny, East Bridge, Kentstown | 697606 | 764987 |
| 5 | Kentstown Stream, Kentstown | 697555 | 766153 |
| 6 | Veldonstown Stream, Veldonstown | 696864 | 765706 |

EPA Biological Water Quality Data

Water quality data from the Environmental Protection Agency (EPA) was not available for the smaller watercourses within the Knockharley study area. It has been reported that the River Nanny is known to be suffering from poor water quality, with less than 40% of the river water bodies monitored in the Nanny-Delvin catchment achieving satisfactory ecological status (EPA, 2018b). Under the Water Framework Directive (2000/60/EC) all rivers should aim to have target 'good status' (Q4). Two monitoring sites on the River Nanny in the vicinity of sampling sites for this survey are failing to meet the requirements of the European Communities Environmental Objectives (Surface Water) Regulations 2009 (i.e. not achieving target good status Q4; EPA, 2019).

The most recent EPA water quality data relevant to the Knockharley survey area is as follows:

- River Nanny, East Bridge, Kentstown (2017) **Q3*** Slightly polluted (WFD Poor status)
- River Nanny, bridge south of Balrath Crossroads (1991, pre-WFD) **Q3-4** Moderately polluted (equivalent to WFD Moderate status)
- River Nanny, bridge downstream Nanny Bridge (2017) **Q3-4*** Moderately polluted (WFD Moderate status)

Contemporary water quality samples were taken as part of this project (August 2019), the results and analysis are provided in this report.

2. Methodology

2.1 Desktop review

A desktop survey of published and unpublished reports (see references) for the Flemingstown (Knockharley) Stream, Kentstown Stream, Veldonstown Stream and River Nanny in the vicinity of the Knockharley Landfill site was undertaken for fisheries and general flora and fauna.

Data on protected species and habitats, as well as invasive species listed under Part 1 of the Third Schedule of S.I No. 477 of 2011, European Communities (Birds and Natural Habitats) Regulations, held by the National Parks & Wildlife Service (NPWS) and National Biodiversity Data Centre (NBDC) were reviewed. Water quality data from the Environmental Protection Agency (EPA) was also referred to for the relevant watercourses (although contemporary samples were taken as part of this survey – see Results section).

2.2 Walkover surveys

Walkover surveys of the Knockharley study area were conducted on Friday 2nd and Thursday 22nd August 2019. The $n=6$ survey locations (Figure 1.2) in the vicinity of the landfill were surveyed in addition to bank walkover surveys to gain an understanding of the longitudinal character of these channels.

Habitat suitability for protected species of conservation interest known or suspected to occur within the study area (e.g. salmonids, lamprey, kingfisher, otter) were conducted, as well as fisheries potential for other species groups, e.g. European eel.

A broad aquatic habitat assessment was conducted utilising elements of the methodology given in the Environment Agency's '*River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003*' (EA, 2003) and the Irish Heritage Council's '*A Guide to Habitats in Ireland*' (Fossitt, 2000). All sites were assessed in terms of:

- Stream width and depth and other physical characteristics
- Substrate type, listing substrate fractions in order of dominance, i.e. large rocks, cobble, gravel, sand, mud etc.
- Flow type, listing percentage of riffle, glide and pool in the sampling area
- In-stream vegetation, listing plant species occurring and their percentage coverage of the stream bottom at the sampling site (as applicable) and on the bankside
- Bankside vegetation composition

The existing environment was described in terms of the important aquatic habitats/species in the vicinity of the landfill. This helped to identify and evaluate species and habitats of ecological value and provide data to inform the EIAR preparation.

2.3 Fish Stock Assessment (Electro-Fishing)

A state-of-the-art single anode Smith-Root LR24 backpack (12V DC input; 300V, 100W DC output) was used to electro-fish $n=6$ sites in the vicinity of the landfill (Figure 1.2) on 22nd August 2019, under the

conditions of a Department of Communications, Climate Action & Environment (DCCA) license. Both river and holding tank water temperature was monitored continually throughout the survey to ensure temperatures of 20°C were not exceeded, thus minimising stress to the captured fish due to low dissolved oxygen levels. A portable battery-powered aerator was used to maintain dissolved oxygen levels for fish.

Salmonids, European eel and other captured fish species (including three-spined stickleback and minnow) were transferred to a holding container with oxygenated fresh river water following capture, where encountered. All captured fish were anaesthetised using 0.5ml/l clove oil solution (emulsified in ethanol at a ratio of 1:9), measured to the nearest millimetre and released in-situ following a suitable recovery period.

As three primary species groups were targeted during the survey, i.e. lamprey, eel/cyprinids and salmonids, the electro-fishing settings were tailored for each species. By undertaking electro-fishing using the rapid electro-fishing technique (see methodology below), the broad characterisation of the fish community at each sampling reach could be determined as a longer representative length of channel can be surveyed. Electro-fishing methodology followed accepted European standards (CEN, 2003) and this is outlined below.

The electro-fishing survey was undertaken across $n=6$ (see Figure 2.1). Length frequency graphs and species composition graphs for all species with numbers captured are illustrated in section 3 (results).

Salmonids, European eel and cyprinids

For salmonid species and European eel, as well as other incidental fish species such as three-spined stickleback and minnow, electro-fishing was carried out in an upstream direction for a 10-minute CPUE, an increasingly common standard approach for wadable streams (e.g. Matson et al., 2018). A channel length approx. 100m was surveyed at each site, where feasible, in order to gain a better representation of fish stock assemblages.

Relative conductivity of the water was checked in-situ with a conductivity meter and the electro-fishing backpack was energised with the appropriate voltage and frequency to provide enough draw to attract salmonids and European eel to the anode without harm. For the relatively high conductivity of watercourses in the vicinity of the landfill (which is due to the calcareous geology), a voltage of 220V, frequency of 40Hz and pulse duration of 4ms was utilised to draw fish to the anode without causing physical damage.

Lamprey species

Electro-fishing for lamprey ammocoetes was conducted using targeted box quadrat-based electro-fishing (as per Harvey & Cowx, 2003) in objectively suitable areas of sand/silt, where encountered. As lamprey take longer to emerge from silts and require a more persistent approach, they were targeted at a lower frequency (20-30Hz) setting which also allowed detection of European eel, if present. Settings for lamprey followed those recommended and used by Harvey & Cowx (2003), APEM (2004) and Niven & McAuley (2013).

Using this approach, the anode was placed under the water’s surface, approx. 10–15 cm above the sediment, to prevent immobilising lamprey ammocoetes within the sediment. The anode was energised with 100V of pulsed DC for 15-20 seconds and then turned off for approximately five seconds to allow ammocoetes to emerge from their burrows. The anode was switched on and off in this way for approximately two minutes. Immobilised ammocoetes were collected by a second operator using a fine-mesh hand net as they emerged.

Lamprey species were identified to species level where possible, with the assistance of a hand lens, through external pigmentation patterns and trunk myomere counts as described by Potter & Osborne (1975) and Gardiner (2003).

2.4 Fisheries habitat

A fisheries appraisal of watercourses in the vicinity of the landfill was also undertaken to establish their importance as salmonid, lamprey, European eel and general fisheries habitat. This assessment considered the quality of spawning, habitat and nursery habitat bordering, and with downstream connectivity to the proposed development site.

Salmonids

Fisheries habitat for salmonids was assessed using the Life Cycle Unit method (Kennedy, 1984; O’Connor & Kennedy, 2002) to map the $n=6$ sites as nursery, spawning and holding water, by assigning quality scores to each type of habitat. Those habitats with poor quality substrata, shallow depth and a poorly defined river profile receive a higher score (Table 2.1). Higher scores in the Life Cycle Unit method of fisheries quantification are representative of poorer value, with lower scores being more optimal despite this appearing counter-intuitive. Overall scores are calculated as a simple function of the sum of individual habitat scores.

Table 2.1 Life Cycle Unit scoring system for salmonid nursery, spawning and holding habitat value (as per Kennedy, 1984 & O’Connor & Kennedy, 2002)

| Habitat quality | Habitat score | Overall score |
|-----------------|---------------|---------------|
| Poor | 4 | 12 |
| Moderate | 3 | 9-11 |
| Good | 2 | 6-8 |
| Excellent | 1 | 3-5 |

Lamprey species

An evaluation of the lamprey importance of $n=6$ sites (see Figure 1.2) was undertaken using the Lamprey Habitat Quality Index (LHQI) scoring system (Macklin et al. 2018) (see Table 2.2).

The LHQI loosely follows the same rationale as the Life Cycle Unit score for salmonids (Kennedy, 1984; O'Connor & Kennedy, 2002). Those habitats with a lack of soft, largely organic sediment areas for ammocoete burrowing, shallow sediment depth (<10cm) or compacted sediment nature receive a higher score. Higher scores in the LHQ method of lamprey fisheries quantification are of poorer value (in a similar fashion to the salmonid Life Cycle Unit Index), with lower scores being more optimal. Overall scores are calculated as a simple function of the sum of individual habitat scores.

Larval lamprey habitat quality as well as the suitability of adult spawning habitat is assessed based on the information provided in Maitland (2003) and other relevant literature (e.g. Gardiner, 2003). Unlike the salmonid Life Cycle Unit index, holding habitat for adult lamprey is not assessed owing to their different migratory and life history strategies, and surveys such as this one routinely only sample larval lamprey.

The LHQI scoring system provides additional information compared to the habitat classification based on the observations of Applegate (1950) and Slade et al. (2003), which deals specifically with larval (sea) lamprey settlement habitat. Under this scheme, habitat is classified into three different types: preferred (Type 1), acceptable (Type 2), and not acceptable for larvae (Type 3) (Slade et al. 2003). Type 1 habitat is characterized by soft substrate materials usually consisting of a mixture of sand and fine organic matter, often with some cover over the top such as detritus or twigs in areas of deposition. Type 2 habitat is characterized by substrates consisting of shifting sand with little if any organic matter and may also contain some gravel and cobble (lamprey may be present but at much lower densities than Type 1). Type 3 habitat consists of materials too hard for larvae to burrow including bedrock and overly-compacted sediment. This classification can also be broadly applied to other lamprey species ammocoetes. The adoption of this system helps inform the LQHI scores.

Table 2.2 Lamprey Habitat Quality Index (LHQI) scoring system for lamprey spawning and settlement habitat value (Macklin et al. 2018), adapted from Kennedy (1984)

| Habitat quality | Habitat score | Overall score |
|-----------------|---------------|---------------|
| Poor | 4 | 8 |
| Moderate | 3 | 6 - 7 |
| Good | 2 | 3 - 5 |
| Excellent | 1 | 2 |

General Fisheries Habitat

A broad appraisal / overview of the upstream and downstream habitat at each site was undertaken to evaluate the wider contribution to salmonid and lamprey spawning and general fisheries habitat. River habitat surveys and fisheries assessments were conducted utilising elements of the approaches in the River Habitat Survey Methodology (Environment Agency, 2003) and Fishery Assessment Methodology (O’Grady, 2006) to broadly characterise the river sites (i.e. channel profiles, substrata etc).

2.5 Q-sampling (macroinvertebrates)

The most recent Q sampling survey undertaken in 2019 in the vicinity of the landfill included n=6 sites (n=6 sites, Figure 1.2, Table 1.1). Several sites outside (upstream) of the landfill (i.e. sites 2, 4 & 6) were sampled to collate contemporary water quality data for the wider Knockharley catchment and to provide upstream control data to compare with downstream.

Macro-invertebrate samples were converted to Q-ratings as per Toner et al. (2005). All riverine samples were taken with a standard kick sampling hand net (250mm width, 500µm mesh size) from areas of riffle/glide utilising a two-minute sample, as per ISO standard methodology (ISO 5667-1:2006). Large cobble was washed at each site where present and samples were elutriated and fixed in 70% ethanol for subsequent laboratory identification. Any rare invertebrate species encountered were identified from the NPWS Red List publications for beetles, stoneflies, mayflies and other relevant taxa. EPA water quality was assigned as per defined EPA categories and corresponding Water Framework Directive (2000/60/EC) Status (Table 2.3).

Table 2.3 Reference Categories for EPA Q Ratings (Q1 to Q5)

| Q Value | WFD Status | Pollution Status | Condition |
|----------------|-----------------|---------------------|----------------|
| Q5 or Q4-5 | High Status | Unpolluted | Satisfactory |
| Q4 | Good Status | Unpolluted | Satisfactory |
| Q3-4 | Moderate Status | Slightly polluted | Unsatisfactory |
| Q3 or Q2-3 | Poor | Moderately polluted | Unsatisfactory |
| Q2, Q1-2 or Q1 | Bad | Seriously polluted | Unsatisfactory |

2.6 Water Quality (physio-chemical)

Water quality samples were taken from n=6 sites on the Flemingstown (Knockharley) Stream, Kentstown Stream, Veldonstown Stream and River Nanny on the 22nd August 2019 (Figure 1.2 and Table 1.1 for sampling locations).

Samples were cooled and delivered to the laboratory on the same day for analysis. To collate updated water quality data for the study area, a range of physio-chemical analysis for each sampling location were laboratory-tested for the following parameters;

- pH
- Alkalinity (mg CaCO₃/l)
- Conductivity @25°C (µS/cm)
- Suspended solids (mg/L)
- Biochemical Oxygen Demand (BOD) (mg O₂/l)
- Chemical Oxygen Demand (COD) (mg O₂/l)
- Total Oxidised Nitrogen (TON) (mg N/l)
- Nitrite (mg N/l)
- Total Ammonia (mg N/l)
- Unionised ammonia (mg N/l)
- Molybdate Reactive Phosphorus (MRP) (mg P/l)

2.7 River Hydromorphological Assessment Technique (RHAT)

To evaluate and catalogue the degree of riverine habitat 'naturalness' along the Flemingstown (Knockharley) Stream, Kentstown Stream, Veldonstown Stream, and River Nanny in terms of their overall ecology (fisheries or otherwise), the River Hydromorphological Assessment Technique (RHAT) was used (Murphy & Toland, 2014).

RHAT expands on the previous standards for river surveys, such as the River Habitat Survey (RHS) methodology (EA, 2003). It is assumed that natural systems support ecology better than modified systems. Hence, the RHAT method classifies river hydromorphology based on a departure from naturalness and allows for the assignment of a morphological classification directly related to Water Framework Directive (WFD) status i.e. High, Good, Moderate, Poor or Bad. Score calculation is based on eight semi-qualitative and quantitative hydromorphological criteria, namely:

- Channel morphology and flow types
- Channel vegetation
- Substrate diversity and condition
- Barriers to continuity
- Bank structure and stability
- Bank and bank top vegetation
- Riparian land use
- Floodplain interaction

The RHAT is designed to be a holistic assessment based on information from both desktop and field (walkover) studies incorporating GIS data, aerial photography and historical data. The RHAT method was developed for WFD classification, but it also has other applications including assessing morphological pressures at a riverine site or reach. It can be used as a tool to determine remedial/restoration work required to improve the river habitat as well as to assess conditions before and after riparian and or riverine works are undertaken.

Following best practice (Murphy & Toland, 2014), RHAT walkover surveys were undertaken along the watercourses in August 2019, when instream and riparian vegetation growth was still visible and readily identifiable. Each watercourse was assessed in discrete 500m sections along both banks. The RHAT hydromorph scores and their corresponding Water Framework Directive (WFD) classification are outlined in Table 2.4.

Table 2.4 RHAT hydromorph scores and their corresponding Water Framework Directive (WFD) classification

| Hydromorph score | WFD Status |
|------------------|-----------------|
| ≥0.8 | High Status |
| ≥0.6 ≤0.8 | Good Status |
| ≥0.4 ≤0.6 | Moderate Status |
| ≥0.2 ≤0.4 | Poor |
| ≤0.2 | Bad |

2.8 Kingfisher (Annex II)

An appraisal of kingfisher (*Alcedo atthis*) habitat in the watercourses within the vicinity of Knockharley Landfill was undertaken based on physical channel attributes, prey resources, potential breeding and nesting habitat and overall water quality.

To gather additional data on kingfisher distribution in the vicinity of the proposed development, vantage point (VP) surveys were also undertaken in accordance with best practice (i.e. SNH, 2017). A total of $n=4$ fixed point VP sites were strategically scoped and utilised to document passing and/or feeding kingfisher moving through areas with good visibility (see Figure 2.2).

As per best practice, VP sites were located at accessible sites with higher visibility and probability of kingfisher occurrence such as bridge crossings or along extensively straightened sections (1 VP within the site boundary and 3 VP's outside of the landfill site boundary). Due to natural site characteristics (e.g. riparian shading), the viewshed for kingfisher VP sites did not exceed 180° visibility nor extend to a distance greater than 2km away (as per SNH (2017) guidelines). Binoculars (8 x 42) were used as required to enhance bird detection. Alarm calls were also listened for as a cue for approaching kingfisher. VP site locations are summarised in Table 2.5.

Given that kingfishers are typically most active in the early morning, the timing of VP surveys reflected this (i.e. 7-11am period). One hour was spent at each VP location and each VP location was visited on

two occasions throughout the survey period (August 2nd & 22nd 2019). Survey efforts were divided equally between two surveyors throughout the monitoring period and VP surveys did not coincide with any other field work activity on site to reduce disturbance.

A desktop review of known distributions of kingfisher within the footprint of Knockharley Landfill and the wider Nanny-Delvin catchment was undertaken (NBDC & NPWS data).

Table 2.5 Summary of vantage point (VP) survey locations for kingfisher in the vicinity of the landfill, Co. Meath surveyed in August 2019

| VP site no. | Watercourse & location | X (ITM) | Y (ITM) |
|-------------|--|---------|---------|
| 1 | Flemingstown (Knockharley) Stream, Curraghtown | 696053 | 767498 |
| 2 | Knockharley lagoon, Knockharley landfill | 697484 | 766710 |
| 3 | Flemingstown (Knockharley) Stream, R150 bridge | 697849 | 766046 |
| 4 | River Nanny, R153 bridge | 699872 | 764722 |

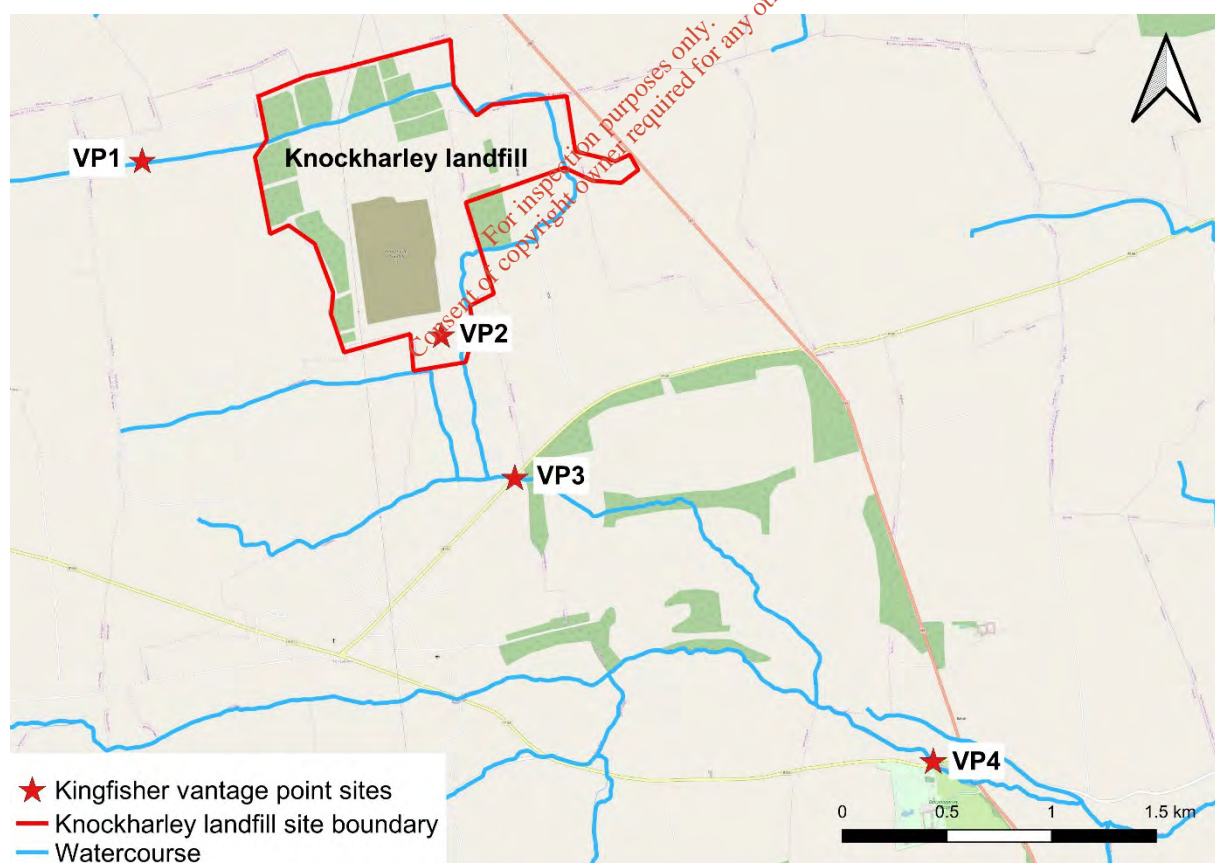


Figure 2.2 Location of the $n=4$ kingfisher VP sites in the vicinity of the landfill.

2.9 Otter (Annex II)

Field surveys for otter (*Lutra lutra*) signs along the watercourses in the study area were conducted in August 2019. The survey was deliberately conducted during a prolonged dry period to ensure that all habitat used by otter could be accessed and to ensure that otter signs (spraint, smears etc.) were not washed away due to recent rainfall events.

The walkover surveys broadly followed the best practice survey methodology for otter as recommended by Lenton et al. (1980), Chanin (2003) and Bailey & Rochford (2006). However, the methodology differed in that the entire waterline was surveyed rather than the standard 500-600m sections from accessible points (e.g. bridges). In this respect, this novel survey technique is known as a total corridor otter survey (TCOS) (Macklin et al., 2019), representing riparian zone and in-channel surveys along both banks of an entire river or river section (the former representing disjointed sections of river channel within a catchment).

Surveys involved the use of two surveyors working independently in tandem along opposite banks of an individual watercourse (where applicable). This facilitates one to work from a more elevated position (e.g. bank top) with one surveying (with appropriate PPE such as a wet suit or chest waders) from within the channel, thus greatly increasing the likelihood of otter sign detection. This is especially true of more cryptic signs such as holts, which can be located in areas out of the view of traditional survey methodologies.

Each watercourse or habitat was divided into equal 500m sections of channel to enable more effective data evaluation against other routinely used ecological value indices such as River Hydromorphological Assessment Technique (RHAT) (Murphy & Toland, 2014).

A continuous, labour-intensive survey effort was adopted in order to comprehensively document otter usage at the river scale as otter sign distribution can be lost within wider, macro-scale studies. Arguably, the finer-scale detail is more important as it helps rationalise otter marking preferences and consolidate our understanding of otter habitat usage. Traditional otter survey methodologies involve inspecting rivers from bridges and other more readily accessible areas, whilst only surveying within ~500m upstream or downstream of these points (Bailey & Rochford, 2006; Gallant et al., 2008). Naturally, while surveys at bridges and accessible areas will detect otter, they will miss otherwise cryptic patterns of otter resource utilisation. By surveying discontinuous blocks, such surveys may also fail to locate important otter signs such as holts, which may fall outside the boundaries of traditional survey reaches (e.g. poorly accessible reaches of river).

The overall value of the habitats within and adjoining the proposed development for breeding and foraging otter was also considered. A desktop review of known distributions of otter within the Knockharley Landfill and wider Nanny-Delvin catchment was undertaken.

2.10 Biosecurity

The clean-check-dry approach was applied as standard to all equipment and PPE used during all surveys. A strict biosecurity protocol was employed during all surveys including the thorough drying (UV exposure) and disinfection of all equipment before and after use with Virkon® to prevent the transfer of pathogens and/ or invasive species between survey areas. Particular cognisance was given to the potential spread of crayfish plague (*Aphanomyces astaci*) given recent outbreaks across Ireland. Electro-fishing and Q-sample surveys were undertaken across the $n=6$ sites in a downstream order to minimise the upstream mobilisation of pathogens or invasive propagules. Any aquatic invasive species or pathogens recorded within or adjoining the survey area were geo-referenced and records forwarded to IFI (as part of their typical license conditions).

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3. Descriptions of sampling locations

Introduction

Please refer to Figure 1.1 when consulting the following site descriptions. Descriptions are provided for the $n=6$ sites across the Flemingstown (Knockharley) Stream, Kentstown Stream, Veldonstown Stream and River Nanny. Sites were visited on both the 2nd August (low water levels) and 22nd August 2019 (above-average water levels).

3.1 Site 1 – Flemingstown (Knockharley) Stream

Site 1 was located on the Flemingstown (Knockharley) Stream, approx. 350m south of the Knockharley Landfill boundary and approx. 150m upstream of the confluence with the Veldonstown Stream (Figure 2.1). Situated in an intensive agricultural landscape (improved agricultural grassland fields (GA1) with arable crop plantations (BC1) upstream), the stream sat in a steep, deep V-shaped channel (bank-full height 2-3m) which had evidently been both historically straightened and deepened. Averaging <1.5m wide, the stream featured very high shading in the vicinity of site 1, with narrow riparian treelines and hedgerows of ash (*Fraxinus excelsior*), hawthorn (*Crataegus monogyna*) providing up to 75% cover. Bramble (*Rubus fruticosus* agg.) scrub dominated in isolated open areas, with frequent great willowherb (*Epilobium hirsutum*) and nettle (*Urtica dioica*), in addition to common species such as curled dock (*Rumex crispus*), hogweed (*Heracleum sphondylium*), bitter-sweet (*Solanum dulcamara*), cow parsley (*Anthriscus sylvestris*), angelica (*Angelica sylvestris*) and rank grasses. Ivy (*Hedera helix*) and hart's tongue (*Asplenium scolopendrium*) were frequent in shaded areas, whilst shaded muddy banks supported common liverwort (*Marchantia polymorpha*).

Water levels varied throughout the survey period, with very low water levels recorded on Friday 2nd August resulting in some shallow riffles (average depth <0.05m) with much of the site dominated by near-stagnant pooling areas (also very shallow). Evidently, the stream featured fluctuating water levels due to rainfall events, with the second site visit featuring a channel dominated by 0.8m deep glide habitat. Substrata were composed predominantly of compacted clay-silt (90%), mostly >0.1m in depth. Given the high shading, macrophyte growth was largely absent although more open areas supported marginal growth of fool's watercress (*Apium nodiflorum*) and pink water speedwell (*Veronica catenata*).



Plate 3.1 Representative image of site 1 on the Flemingstown (Knockharley) Stream approx. 0.35km downstream (south) of the Knockharley Landfill site boundary, 2nd August 2019.

Site 2 – Flemingstown (Knockharley) Stream

Site 2 was located at a farm access bridge on the Flemingstown Stream approx. 0.6km upstream of the Knockharley Landfill site boundary (Figure 2.1). Being located upstream of the proposed development. This site acted as a control site in terms of upstream water quality and fisheries habitat.

This site was bordered by intensive agricultural land (GA1) on all sides and featured high riparian shading (up to 90%) from ash and hawthorn-dominated treelines in addition to dense bramble-dominated scrub. Largely due to the high degree of shading and naturally fluctuating water levels, instream macrophyte and bryophyte communities were limited to marginal growth of water mint (*Mentha aquatica*), with some filamentous algae (*Cladophora* spp.). There was frequent in-stream large woody debris blocking the flow in the vicinity of this site (notably downstream).

The stream at this location had evidently been extensively straightened and deepened historically upstream of the landfill site boundary (some limited sinuosity retained downstream) and mostly sat in a steep V-shaped channel with a bank-full height of >1.2 to 2m. The banks were deeply cut and near-vertical at several points. Channel width was typically 2-2.5m but water width was often <1m. Water flow was imperceptible during the first site visit (2nd August) with only 0.05-0.1m deep pooling areas present. Rainfall events resulted in much higher temporary flows during the second visit (22nd August) and the site was dominated by 0.1-0.2m deep fast glide and riffle habitat, with limited pool. The substrata were dominated by fine to medium gravels and small cobble, with small boulder frequent. These were highly bedded, however. Silt pockets, where present, were also compacted. Fisheries value was very low at the time of survey, apart from three-spined stickleback, which were present in localised pools and lower flow areas.



Plate 3.2 Representative image of the Flemingstown (Knockharley) Stream downstream of site 2 approx. 0.6km upstream (west) of the Knockharley Landfill site boundary on 22nd August 2019

Site 3 – River Nanny, R153 bridge crossing

Site 3 on the River Nanny was located a short distance upstream from Balrath Crossroads and approximately 3.6km downstream of the Knockharley landfill site boundary. The channel was situated in an intensive agricultural landscape (pasture, GA1) both upstream and downstream of the bridge site, whilst the channel also bordered Ballymacgarvey Village golf course (amenity grassland habitat GA2) for a short distance downstream of the bridge. The river had been historically straightened and to a lesser extent deepened, with flood embankments present upstream of the bridge. The river channel averaged 6-7m in width in a shallow-U profile. Glide habitat dominated throughout although some shallower riffles with associated pools (some >1m) existed upstream. As with other sites, water levels were below basal summer levels on 2nd August (average 0.3-0.6m in depth) and, due to rainfall events, above average on 22nd August (0.6-1m). Deeper holding habitat for adult salmonids was present underneath and downstream of the bridge structure, with some locally good nursery habitat present upstream.

The site featured open banks (unfenced, little or no riparian zone) exposed to heavy livestock poaching for a considerable distance upstream of the bridge. Siltation was high throughout although some moderate-quality gravels existed in naturally higher-flow areas. A small (15m²) area of loose cobble and gravel existed immediately upstream of the bridge and provided valuable salmonid (and probably lamprey) spawning opportunities. Higher flow levels on the second site visit had evidently mobilised much of the silt deposits downstream of the bridge and some moderate to good quality cobble and coarse gravel substrata were exposed. Nevertheless, the substrata was bedded.

Downstream of the bridge, bordering maintained grassland, the river retained some better levels of naturalness (see RHAT section below), with ash-dominated treelines and herbaceous riparian zone composed of reed canary grass (*Phalaris arundinacea*), hedge bindweed (*Calystegia sepium*), nettle, great willowherb, marsh willowherb (*Epilobium palustre*) and occasional hogweed. The channel was heavily silted downstream of the bridge (mostly slower, deeper glide >0.5m) and was often heavily encroached by macrophyte vegetation such as branched bur reed (*Sparganium erectum*), with localised fool's watercress and watercress (*Nasturtium officinale*). On the second site visit, much of the soft sediment in this area was evidently mobilised downstream due to higher flows resulting from rainfall events. Common duckweed (*Lemna minor*) was present marginally. Some limited stream water crowfoot (*Ranunculus pennicillatus*) was present throughout the site, especially upstream of the bridge where faster flow rates were present. During low water levels, filamentous algal cover was high, covering >50% of the substrata and instream submergent macrophyte community. This coverage reduced substantially at higher flows.



Plate 3.3 Representative image of site 3 on the River Nanny downstream of the R153 road bridge approx. 3.6km downstream of the Knockharley Landfill site boundary on 2nd August 2019.



Plate 3.4 Representative image of site 3 on the River Nanny downstream of the R153 road bridge on 22nd August 2019 during higher water levels.

Site 4 – River Nanny, East Bridge

Site 4 on the River Nanny was situated in an agriculturally-dominated landscape, bordered by extensive Improved agricultural grassland (GA1). However, a large area of dry meadow (GS2) habitat, dominated by reed canary grass with common forb species such as great willowherb and meadowsweet (*Filipendula ulmaria*), existed upstream of the bridge on the south bank. A similar area of GS2 habitat was present approx. 100m downstream of the bridge on the south bank. A small block of mixed broadleaved woodland (WD1), supporting pedunculate oak (*Quercus robur*), horse chestnut (*Aesculus hippocastanum*), sycamore (*Acer pseudoplatanus*), ash and hawthorn bordered the channel on the south bank immediately downstream of the bridge.

As with downstream, the Nanny at this location has been evidently straightened and deepened historically. Featuring steep U-shaped banks and glide-dominated habitat, the channel averaged 2.5-3m in width and 0.3-0.4m deep at basal summer levels (0.7-1m at higher water levels). The site was heavily silted (90% of substrata) and heavily choked with instream macrophyte vegetation both upstream and downstream of the bridge (often 80% cover). Branched bur-reed dominated with frequent reed canary grass and a high level of encroachment from terrestrial herbaceous species. Although harder substrata (gravels and cobble) existed below, the bed was composed almost entirely of silt at this site, typically >0.1m in depth. This did provide some suitability for larval lamprey although levels of compaction and low basal flows may have reduced this potential. Likewise, although some suitability for salmonids existed, particularly underneath and downstream of the bridge, siltation reduced this considerably.



Plate 3.5 Representative image of site 4 on the River Nanny at East Bridge, facing downstream.



Plate 3.6 Representative image of site 4 on the River Nanny at East Bridge, a short distance downstream of the bridge.

Site 5 – Kentstown Stream

The Kentstown Stream is a small channel which runs through an intensive agricultural landscape, parallel to the Flemingstown (Knockharley) Stream in its lower reaches. The upper reaches flowed through extensive arable crop plantations (BC1) and bordered immature broadleaf plantation (WS2) at the Knockharley Landfill site boundary approx. 650m upstream of the sampling point at site 5.

The channel has been historically straightened and deepened and was more representative of a drainage ditch (FW4) habitat than a small stream. Featuring a bank-full height of 1-1.2m in a steep U-shaped channel, the channel contained little water at the time of survey on 2nd August, with an imperceptible flow and only localised standing water present, even near the confluence with the

Veldonstown Stream where the natural gradient increased (site 6). Water levels were higher on the second site visit on 22nd August although the channel depth was still only 0.2-0.3m.

Whilst not as heavily shaded as the adjacent Flemingstown (Knockharley) Stream (site 1), the banks were dominated by a high cover of willowherb species, bittersweet, meadowsweet, nettle, rank grasses and creeping thistle (*Cirsium arvense*). Some patchy ash and hawthorn grew along the channel. With an average width of <1m, the stream at this site was choked with both terrestrial and macrophyte vegetation, particularly fool's watercress and duckweed (80% cover overall). Substrate was composed entirely of silt throughout and fisheries value was very low.



Plate 3.7 Representative image of site 5 on the Kentstown Stream approx. 650m downstream of the Knockharley Landfill site boundary.

Site 6 – Veldonstown Stream

Site 6 was located at a road crossing in the upper reaches of the Veldonstown Stream approx. 800m upstream of the Kentstown Stream confluence (site 5). The stream sat amidst a landscape of agricultural pasture (GA1) and arable crops (BC1). The stream was (30cm pipe) culverted under several residential properties as well as the road. Downstream of the road crossing, the watercourse had been historically straightened and extensively deepened throughout, with steep, narrow V-shaped banks exceeding 2.5m bank-full height. The channel width was <1.5m and contained little water at the time of survey on 2nd August, with stagnant pools present locally (90% dry). A stagnant, heavily-silted pool area, supporting three-spined stickleback and fool's watercress, was present at the road crossing. Water levels were higher on 22nd August although the average depth was still appreciably low at 0.1-0.2m. At higher water levels, the stream was dominated by shallow riffle habitat. A discernible foul odour was evident at this site upstream of the road crossing and a slight discolouration (grey) indicating surface water run-off was present. This was not associated with Knockharley Landfill given geographical separation (i.e. located upstream of the confluence with the Knockharley Stream; Figure 1.1). Although some good fractions of fine to medium gravels were present along with frequent small cobble and small boulder, substrata were invariably heavily bedded and compacted.

Riparian shading from hawthorn hedgerows and ash treelines was very high, including at the sampling site itself. Upstream of the site, the channel was culverted under the road (pipe culverts) and several residential properties, with agricultural grassland bordering the uppermost reaches. Given the high shading and evident fluctuating water levels, macrophyte cover was largely absent although some fool's watercress and duckweed was present in wetter areas of channel. Apart from some localised pool areas for three-spined stickleback, the channel offered very little fisheries potential at the time of survey.



Plate 3.6 Representative image of site 6 on the Veldonstown Stream, located approx. 800m upstream of the Kentstown Stream confluence.

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4. Results

Fish Stock Assessment (electro-fishing)

This section presents the results of the electro-fishing survey at $n=6$ watercourses in the vicinity of the landfill (Figure 1.2). The survey sites were fished on the 22nd August 2019.

Site 1 – Flemingstown (Knockharley) Stream

Three-spined stickleback was the only species recorded during electro-fishing at site 1. Low numbers were captured from pool areas of the channel ($n=5$). Above-average water levels at the time of survey had likely localised the stickleback population to such slacker areas, which were heavily encroached. Although the site was dominated by silt substrata, no optimal larval lamprey habitat was recorded, with any soft sediment invariably compacted. Banks were heavily encroached by riparian growth of hedgerow and scrub species. No salmonids or eel were captured during the survey.

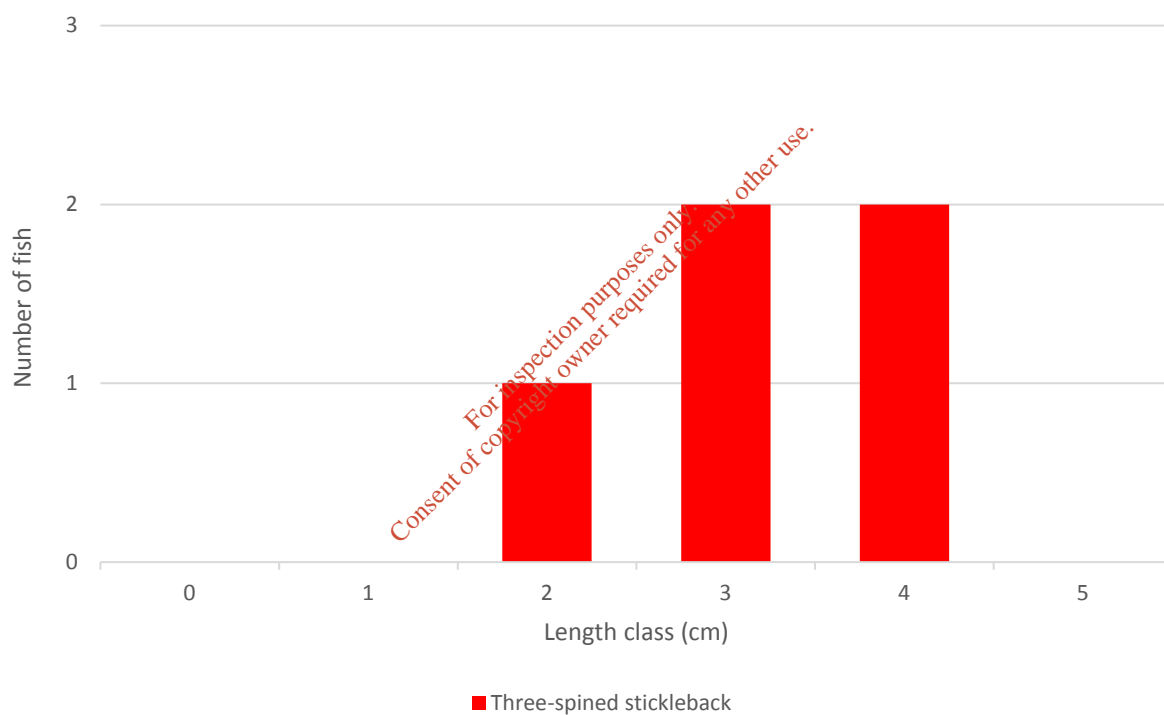


Figure 4.1 Fish length frequency graph prepared for fish species recorded at site 1 on the Flemingstown (Knockharley) Stream downstream of Knockharley Landfill in August 2019.



Plate 4.1 Electro-fishing during on the Flemingstown (Knockharley) Stream at site 1, August 2019.

Site 2 – Flemingstown (Knockharley) Stream

Three-spined stickleback was the only species recorded during electro-fishing at site 2, with low numbers ($n=4$) present in marginal foal's watercress beds and a small pool area underneath the farm access bridge culvert. No optimal larval lamprey habitat was recorded at this site, with any soft sediment present invariably compacted. No salmonids or eel were captured during the survey.

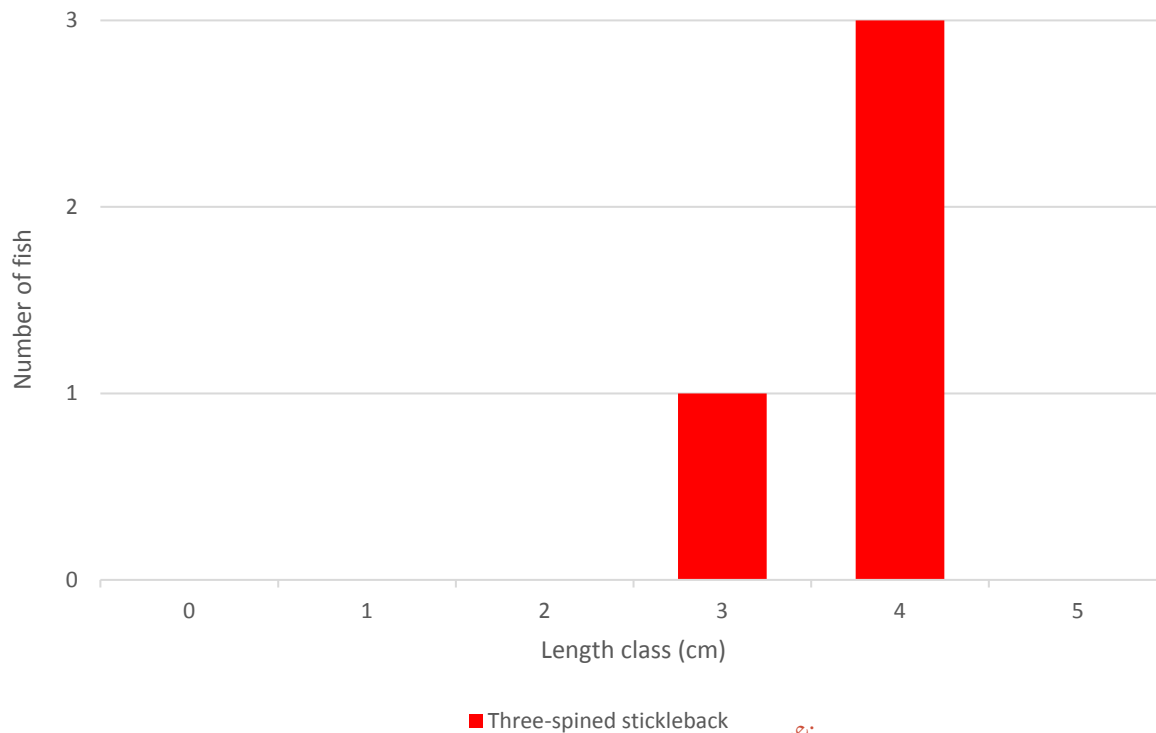


Figure 4.2 Fish length frequencies recorded via electro-fishing at site 2 on the Flemingstown (Knockharley) Stream upstream of Knockharley landfill in August 2019.

Site 3 – River Nanny, R153 bridge crossing

Site 3 on the River Nanny supported the most diverse range of fish recorded during this survey, with a total of five fish species captured. Brown trout were the most abundant ($n=22$), followed by minnow ($n=12$). A range of adult and juvenile brown trout size classes were recorded. Stone loach were present in low numbers, with a single European eel recorded from near the bridge structure. Three-spined stickleback were present in modest numbers at this site but were largely confined to a stagnant pooling area underneath the southernmost bridge arch and not in the main flow of the river. No larval lamprey was recorded despite some suitability in marginal soft sediment areas.

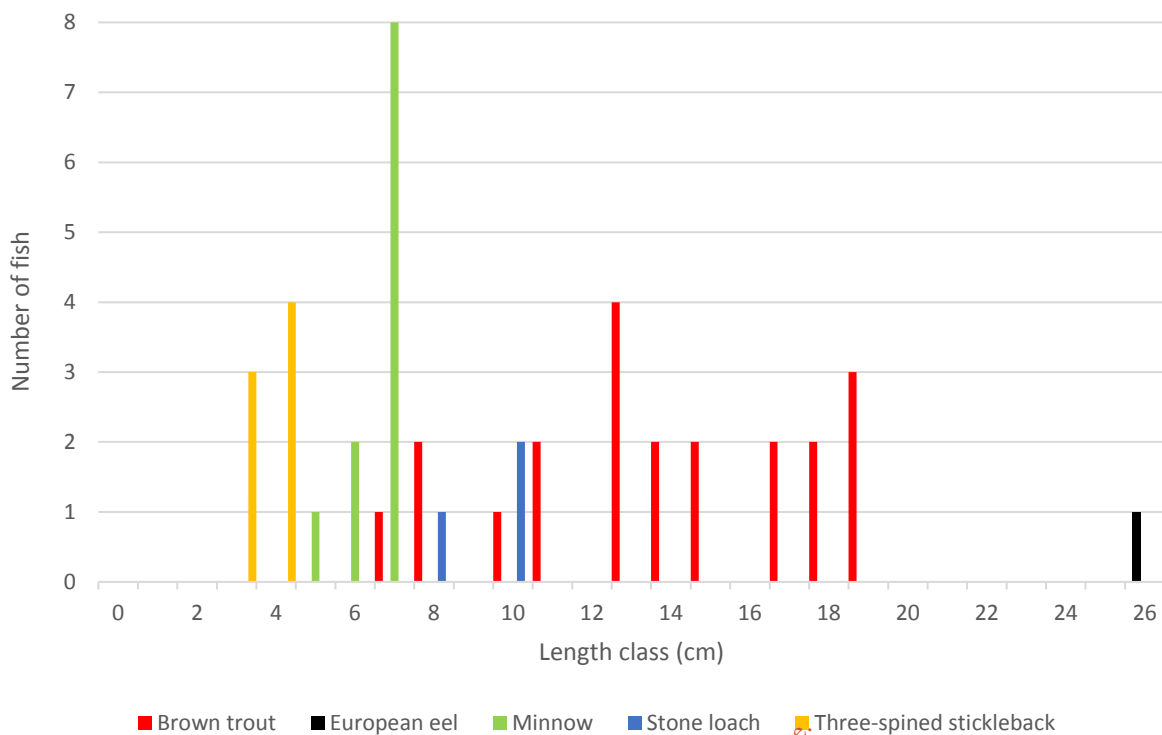


Figure 4.3 Fish length frequencies recorded via electro-fishing at site 3 on the River Nanny at the R153 bridge crossing in August 2019



Plate 4.2 Top to bottom: adult brown trout, juvenile brown trout and minnow recorded from site 3 on the River Nanny.

Site 4 – River Nanny, East Bridge

Minnow was the most numerous species recorded at site 4 on the River Nanny ($n=11$). Brown trout were present in low densities ($n=5$), with no juveniles recorded. A single European eel was also captured, near the bridge structure. Despite some suitability in terms of the presence of soft sediment (silt dominated substrata), no larval lamprey was recorded.

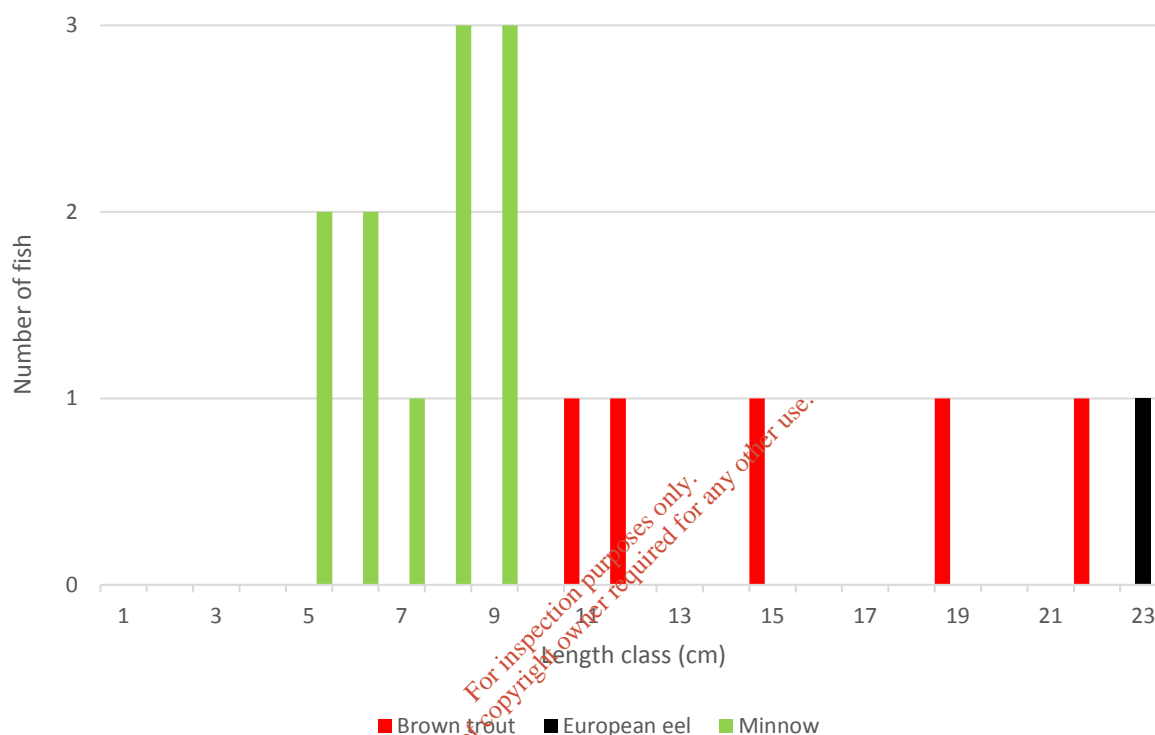


Figure 4.4 Fish stock length distribution recorded via electro-fishing at site 4 on the River Nanny at East Bridge in August 2019



Plate 4.3 Adult minnow recorded from site 4 on the River Nanny at East Bridge

Site 5 – Kentstown Stream

There were no fish recorded via electro-fishing from site 5 on the Kentstown Stream on 22nd August 2019. The fisheries potential was considered very low, with low potential for salmonids at this location given the high levels of siltation and overgrowth nature of the small channel. Evident fluctuating flow rates likely eliminated the potential of the channel to support resident fish stocks, although some suitability for three-spined stickleback was present albeit none were recorded during the current survey.

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Plate 4.4 Electro-fishing site 5 on the Kentstown Stream.

Site 6 – Veldonstown Stream

Three-spined stickleback was the only fish species captured at site 6 on the Veldonstown Stream, with high densities recorded both upstream and downstream of the road crossing (total $n=28$). A range of size and age classes were present. Fish were largely localised in small pooling areas ($<0.5\text{m}^2$) associated with pipe culverts at the time of survey (above-average water levels). No lamprey, salmonids or eel were recorded during the survey.

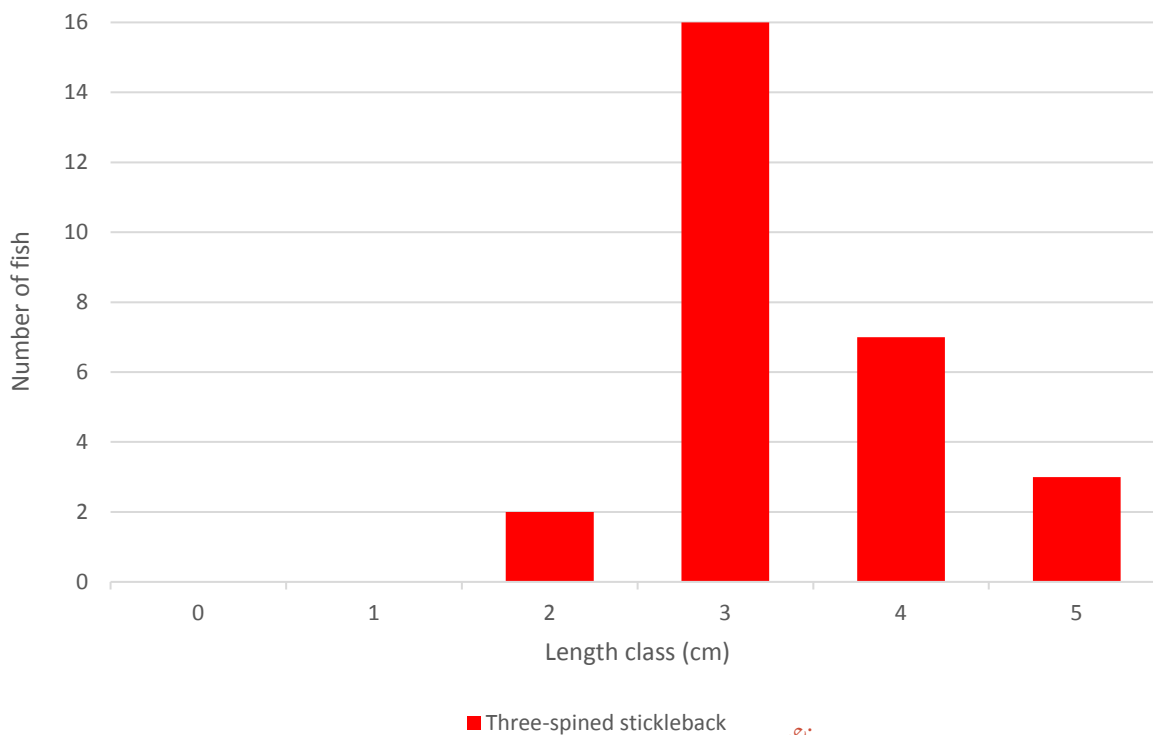


Figure 4.5 Fish stock length frequency distribution recorded via electro-fishing at site 6 on the Veldonstoun Stream in August 2019



Plate 4.5 High densities of both adult and juvenile three-spined stickleback were the only fish recorded from site 6 on the Veldonstoun Stream.

Fisheries habitat

Salmonids

The salmonid habitat quality of the surveyed sites in the vicinity of Knockharley Landfill was poor with only the River Nanny sites (3 & 4) offering good salmonid habitat as summarised in the Life Cycle Unit scores (Kennedy, 1984; O' Connor and Kennedy, 2002) in Table 4.1. Unlike the other smaller watercourses in the vicinity of Knockharley landfill, the two River Nanny sites offered superior salmonid habitat in terms of nursery and (adult) holding, with deeper glides and pools present. Site 3 offered the better quality salmonid habitat given its localised spawning substrata (immediately upstream of the bridge especially) in addition to good quality nursery and holding areas. The improved flows and larger size of the River Nanny (i.e. sites 3 and 4) over other survey sites in the vicinity of the landfill (i.e. 1, 2, 5 and 6) evidently benefited salmonids. Sites 1, 2, 5 and 6 (Flemigstown, Kentstown and Veldonstown Streams) were deemed largely unsuitable for resident salmonids at the time of survey and none were recorded from these sites.

Table 4.1 Summary of the salmonid Life Cycle Unit scores for the sites in the vicinity of Knockharley Landfill surveyed.

| Site | Salmonid habitat value | Spawning | Nursery | Pool (holding) | Total Score | Salmonids recorded |
|------|------------------------|----------|---------|----------------|-------------|--------------------|
| 1 | Poor | 4 | 4 | 4 | 12 | No |
| 2 | Poor | 4 | 4 | 4 | 12 | No |
| 3 | Good | 2 | 2 | 2 | 6 | Yes |
| 4 | Good | 4 | 2 | 2 | 8 | Yes |
| 5 | Poor | 4 | 4 | 4 | 12 | No |
| 6 | Poor | 4 | 4 | 4 | 12 | No |

Note: lower scores indicate superior habitat.

Lamprey habitat

The lamprey habitat of the n=6 sites surveyed was poor overall as outlined in Table 4.2. The lamprey habitat types according to Applegate (1950) and Slade et al. (2003) fell into type 2 and type 3 categories. Type 2 habitat is characterized by substrates consisting of shifting sand with little if any organic matter and may also contain some gravel and cobble (lamprey may be present but at much

lower densities than Type 1), while type 3 habitat consists of materials too hard for larvae to burrow including bedrock and overly-compacted sediment.

The sites on the smaller watercourses (i.e. sites 1, 2, 5 and 6) offered little or no lamprey spawning or nursery habitat given the bedded / silted nature of substrata as well as low flows and evidently fluctuating water levels. However, the sites on the River Nanny (i.e. sites 3 and 4) offered good and moderate lamprey habitat respectively. Site 3, located at the R153 road bridge, provided the best lamprey habitat overall, with both suitable spawning substrata (especially immediately upstream of the bridge) in addition to suitable soft sediment for ammocoetes, especially downstream of the bridge – much of this, however, appeared transitory in nature. Site 4, at East Bridge, offered some good larval nursery habitat but excessive siltation and a general lack of flow due to heavy instream macrophyte growth reduced the spawning potential for lamprey considerably.

Table 4.2 Lamprey Habitat Quality Index (LHQI) scoring system for lamprey habitat value for the sites in the vicinity of Knockharley Landfill.

| Site | Lamprey habitat value | Spawning | Nursery | Total Score | Habitat type present* |
|------|-----------------------|----------|---------|-------------|-----------------------|
| 1 | Poor | 4 | 4 | 8 | Type 3 |
| 2 | Poor | 4 | 4 | 8 | Type 3 |
| 3 | Good | 2 | 3 | 5 | Type 2 |
| 4 | Moderate | 4 | 2 | 6 | Type 2 |
| 5 | Poor | 4 | 4 | 8 | Type 3 |
| 6 | Poor | 4 | 4 | 8 | Type 3 |

*Note: Habitat type is assessed according to Applegate (1950) and Slade et al. (2003) – see methodology section

European eel Habitat

The River Nanny at sites 3 and 4 offered the best eel habitat, with greater refugia (vital for the species) in terms of instream macrophytes and boulders, as well as better prey resources and superior water quality (refer to site description & Q sampling results below). The Flemingstown (Knockharley), Kentstown and Veldonstown Streams (i.e. sites 1, 2, 5 and 6) offered poor eel habitat despite apparent unimpeded access (based on the site walkover) across all sites, again. However low summer water levels may affect eel settlement in the smaller stream sites. In conclusion, European eel habitat was poor overall in the smaller stream sites (1, 2, 5 and 6) but moderate in the River Nanny (sites 3 and 4).

Aquatic Invasive species

A desktop review of available data (held by the NPWS & NBDC) revealed no existing records of invasive aquatic species within in the vicinity of the proposed development (i.e. located in 10km national grid square N96). This was also confirmed during the aquatic surveys and monitoring.

Kingfisher

No kingfishers were recorded during vantage point (VP) surveys across $n=4$ VP sites. However, a single kingfisher was recorded during walkover surveys (Figure 4.6). An adult bird was observed in flight heading upstream along the Flemingstown (Knockharley) Stream near the landfill boundary, between sites VP2 and VP3. The kingfisher was possibly heading to the existing Knockharley surface water attenuation pond where suitable prey resources exist (i.e. three-spined stickleback that were recorded present in the pond during the sweep netting for aquatic invertebrates).

Despite the presence of three-spined stickleback within sections of the Flemingstown (Knockharley) Stream, Kentstown Stream and Veldonstown Stream, along with more diverse fish stocks in the River Nanny, kingfisher habitat was typically considered sub-optimal. The smaller watercourses were invariably heavily overgrown (scrub vegetation) with steep but compacted banks not suitable for kingfisher nesting. Suitable perch sites were also noted as being scarce along large sections of the River Nanny and smaller watercourses. No kingfisher nesting sites were recorded during walkover surveys.

Otter

A low number of otter signs ($n=3$) were recorded along the watercourses in the vicinity of Knockharley Landfill during walkover surveys in August 2019 (Table 4.3, Figure 4.6). All signs consisted of spraint with two sites recorded at bridges along the River Nanny, at sites 3 and 4, respectively. An additional and very regular spraint site was also recorded on the inflow pipe culvert to the existing landfill surface water attenuation pond. No otter holts were recorded during the site walkover which included the surface water attenuation pond area.

An additional historical record was available for the River Nanny upstream of the R153 road bridge (site 3) (Chapman & Chapman, 1982). According to the EIAR, during 2010, two otter spraint sites were recorded along the Knockharley Stream at monitoring site 2. In 2015, otter spraint was again recorded along the Knockharley Stream (NW of Landfill) as well as on drainage channels to the west and northwest of the Landfill site (FT, 2018).



Plate 4.6 A regular otter spraint site (with nearby prints) recorded at the inflow culvert to the existing surface water attenuation pond, August 2019

Table 4.3 Summary of otter signs recorded during walkover surveys of the watercourses and habitats in the vicinity of Knockharley Landfill near Navan, Co. Meath

| Nearest site location | Watercourse | Otter sign | Sign age | Comments | ITM x | ITM y |
|-----------------------|--|------------------|----------|--|--------|--------|
| 1 | Knockharley surface water attenuation pond | Spraint | Mixed | Regular spraint site (10+) at entrance to lagoon culvert | 697504 | 766792 |
| 3 | River Nanny, R153 bridge | Spraint | Old | Old spraint site on mid-channel rock u/s of bridge | 699873 | 764734 |
| 4 | River Nanny, East Bridge | Spraint & prints | Fresh | Spraint & prints in paludal mud under 3 rd arch of bridge | 697625 | 764990 |

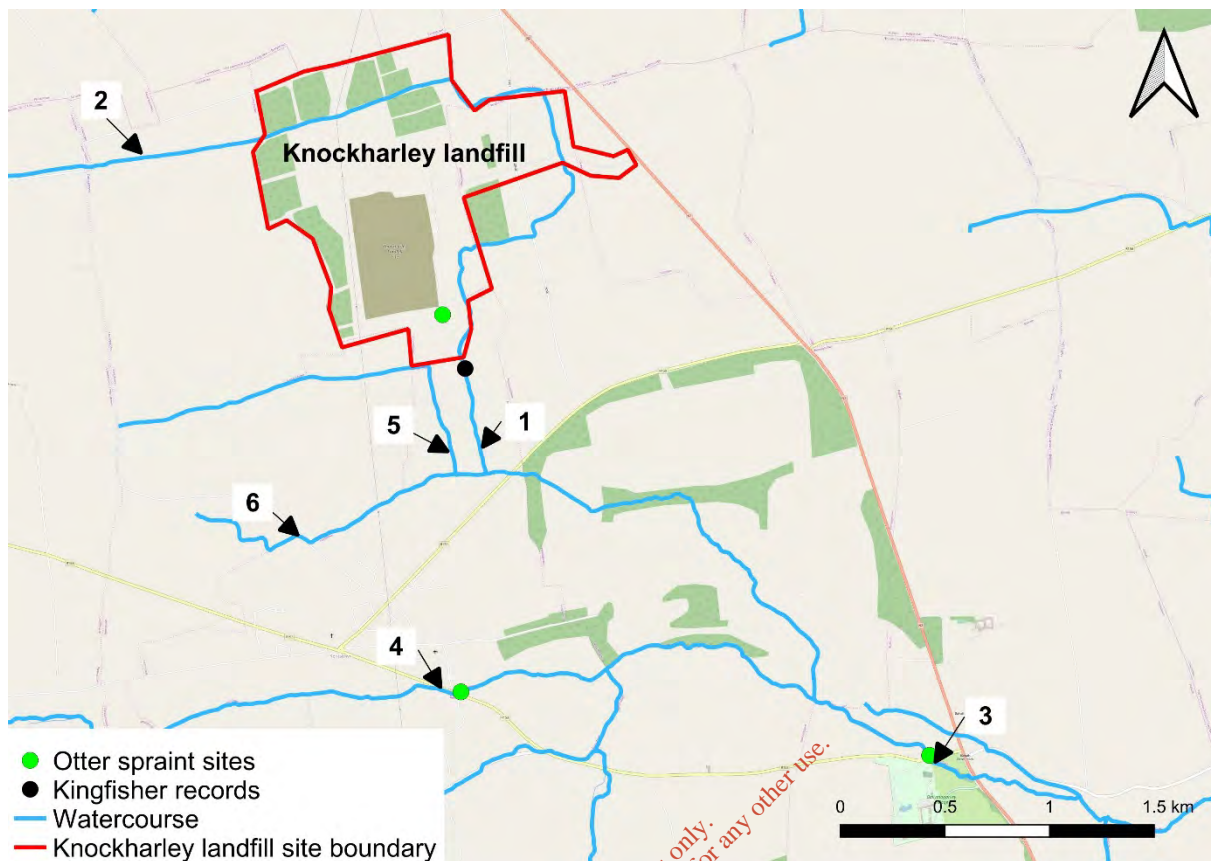


Figure 4.6 Location of otter signs and single kingfisher observation as recorded during walkover surveys of watercourses in the vicinity of Knockharley Landfill, August 2019

Q-sampling (macroinvertebrates)

Q-samples were collected and analysed from $n=6$ sites watercourses in the vicinity of the landfill. A total of $n=28$ species across $n=25$ families were recorded as outlined in Table 4.4.

Samples collected from sites 5 (Kentstown Stream) and 6 (Veldonstown Stream) should be considered as tentative only given that the sites featured an imperceptible flow (virtually stagnant) at the time of sampling. This is considered as Q-samples are typically collected from riffle-glide areas of channel with ample flows according to Toner et al. (2005). Samples collected at sites 1, 2, 3 and 4 were from riffle-glide habitat and therefore comply well with the Q-sampling methodology. The sampling locations monitored were as per previous monitoring, with the addition of sites 5 and 6 to provide additional data on watercourses to the south of the landfill.

Following the methodology of Toner et al. (2005), the Environmental Protection Agency (EPA) which group invertebrates into classes whereby pollution intolerant species are denoted class A, and species with greater pollution tolerance fall into successive classes (B through E, respectively). As such, the presence or absence of these groups and their relative abundance facilitates an assessment of biological river health. The results are discussed in this context in order to interpret potential changes in the river community composition. The taxonomic composition for each site is summarised on Table 4.4. Q sampling ratings for each site are illustrated on Figure 4.7.

Site 1 was located on the Flemingstown (Knockharley Stream) downstream of the landfill site. It had a similar composition to site 2 upstream. There was an absence of clean-water indicator species (i.e. EPA class A and B mayflies and stoneflies). Only a single EPA class B (i.e. cased caddis species) was present (i.e. indicative of better water quality). The presence of good numbers EPA pollution tolerant Class D taxa (*Asellus aquaticus*) and smaller numbers of the very pollution tolerant class E (*Chironomus* spp.) indicated a Q-rating of Q2-3 (moderately polluted, poor WFD status).

Survey site 2 was located on the Flemingstown (Knockharley) Stream upstream of the landfill site and was like site 1 in that there was an absence of clean-water indicator species (i.e. EPA class A and B mayflies and stoneflies). The sample had several EPA class C species at low densities and was more dominated by pollution tolerant gastropods and bivalves i.e. Planorbiidae, Physidae and Sphaeriidae (EPA class D). The sample composition downstream of the landfill indicated the water quality was of Q2-3 (moderately polluted, poor WFD status).

The River Nanny at the R153 bridge crossing, downstream of the landfill (site 3) had biological water quality that slightly improved from sites 1 and 2. The presence of mayfly species Baetidae and Ephemerellidae (EPA Class C) indicated some improvement from upstream as mayflies were absent. The presence of cased caddis (EPA class B) at small numbers also indicated some improvement in biological water quality. Furthermore, the absence of EPA Class D & E (i.e. pollution tolerant species) supported an observed improvement from upstream. In summary the water quality at site 3 while still poor overall, improved from sites 1 and 2 upstream with a Q-rating of Q3 recorded (moderately polluted, poor WFD status).

Site 4 was situated on the River Nanny upstream of the Flemingstown (Knockharley) Stream confluence. The biological water quality was poor as reflected by the absence of EPA class A and B stonefly and mayfly species. The presence of higher numbers of *Asellus aquaticus* (EPA class D) and the presence of leech species *Erpobdella octoculata* and *Glossiphonia complanata* (also EPA class D) further indicated poor water quality. In summary the sample composition at site 4 on the River Nanny (upstream of confluence with the Flemingstown Stream) indicated the water quality was of Q2-3 (moderately polluted, poor WFD status).

Both sites 5 on the Kentstown Stream and site 6 on the Veldonstown Stream were heavily modified watercourses (effectively drainage channels) with imperceptible flows of water at the time of sampling. Both sites had a very low number of invertebrate species present and comprised mainly of the snail species *Radix balthica* (EPA class D) and also *Asellus aquaticus* (EPA class D). Given the condition of the channels as sub-optimal for Q-sampling a **tentative** Q-rating of Q2 (seriously polluted, bad status) was applied for both sites.

No rare macroinvertebrate species were recorded from the $n=6$ sampling locations.

The surface water attenuation pond at Knockharley had an invertebrate sample collected from the macrophytes present at the margins. Species typical of a pond environment were recorded (i.e. gastropods, damselfly larvae and pond olives). A low to moderate diversity ($n=9$) species was recorded with no rare species present. Three-spined stickleback were also recorded in the sample.

The invertebrate Q-sampling was summarised as follows at the $n=6$ sampling sites, with no site achieving good status Q4 water quality as required under the Water Framework Directive (2000/60/EC). The WFD is enforced under the European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 which sets targets for Q4 and above (i.e. Q4-5 & Q5) for riverine sites. A summary of the Q-ratings for each site is provided below as illustrated on Figure 4.7;

- Site 1 (Flemingstown (Knockharley) Stream) **Q2-3** Moderately polluted (WFD Poor Status)
- Site 2 (Flemingstown (Knockharley) Stream) **Q2-3** Moderately polluted (WFD Poor Status)
- Site 3 (River Nanny) **Q3** Moderately polluted (WFD Poor Status)
- Site 4 (River Nanny) **Q2-3** Moderately polluted (WFD Poor Status)
- Site 5 (Kentstown Stream) **Q2** Seriously polluted (WFD Bad status)
- Site 6 (Veldonstown Stream) **Q2** Seriously polluted (WFD Bad Status)

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Table 4.4 Macro-invertebrate composition and associated Q-ratings for the watercourses in the vicinity of Knockharley Landfill.

| Group | Family | Species | Site 1 | Site 2 | Site 3 | Site 4 | Site 5 | Site 6 | Lagoon | EPA Class |
|-------------------|---------------------------------------|-------------------------|--------|--------|--------|--------|--------|--------|--------|-----------|
| Baetidae | <i>Cloeon dipterum</i> | Pond olive | | | | | | | 2 | C |
| Baetidae | <i>Baetis rhodani</i> | Dark olive | | 2 | 12 | | | | | C |
| Ephemereillidae | <i>Seratella ignita</i> | Blue winged olive | | | 16 | | | | | C |
| Limnephilidae | <i>Limnephilus sp. (young instar)</i> | Cased caddis | 1 | | | | | | | B |
| Limnephilidae | <i>Potamophylax latipennis</i> | Cased caddis | | | 2 | | | | | B |
| Seracostomatidae | <i>Seracostoma personatum</i> | Cased caddis | | | | 2 | | | | B |
| Ryacophilidae | <i>Ryacophila dorsalis</i> | Caseless caddis | | | 2 | | | | | C |
| Polycentropodidae | <i>Holocentropus picicornis</i> | Caseless caddis | | 3 | | | | | 3 | C |
| Gammaridae | <i>Gammarus duebenii</i> | Freshwater shrimp | 23 | | 21 | 9 | | | | C |
| Coenagrionidae | <i>Coenagrion pulchellum</i> | Variable damselfly | | 1 | | | | | 6 | C |
| Pediciidae | <i>Dicranota sp.</i> | Crane fly larvae | 2 | | 4 | 3 | | | | C |
| Paelobiidae | <i>Hygrobia hermanni</i> | Water beetle | | 1 | | | | | 2 | C |
| Halplidae | <i>Brychius elevatus</i> | Crawling water beetle | | | 1 | | | | | C |
| Elmidae | <i>Elmis aenea</i> | Riffle beetle | | | 3 | | | | | C |
| Corixinae | <i>Corixa punctata</i> | Water boatman | | 3 | | | | | 5 | C |
| Ancylidae | <i>Ancylus fluviatilis</i> | River limpet | 2 | | 6 | | | | | C |
| Sphaeriidae | <i>Sphaerium corneum</i> | Horny orb mussel | | 9 | | | | | 2 | D |
| Hydrobiidae | <i>Potamopyrgus antipodarum</i> | Jenkin's spire snail | | 31 | | | | | 5 | C |
| Planorbiidae | <i>Gyraulus crista</i> | Nautilus ramshorn snail | 1 | 1 | | | | | | D |
| Asellidae | <i>Asellus aquaticus</i> | Freshwater hoglouse | 9 | 5 | | 41 | 6 | 2 | 4 | D |

| Group | Family | Species | Site 1 | Site 2 | Site 3 | Site 4 | Site 5 | Site 6 | Lagoon | EPA Class |
|---------------------------|--------------------------------|------------------|-------------|-------------|-------------|-------------|-----------------------|-----------------------|------------------------|-----------|
| Physidae | <i>Physa fontanalis</i> | Bladder snail | | | | 1 | | | | D |
| Lymnaeidae | <i>Radix balthica</i> | Wandering snail | 1 | 4 | | | 83 | 8 | 6 | D |
| Lymnaeidae | <i>Lymnaea sternalis</i> | Great pond snail | | | | | | 1 | | C |
| Valvatidae | <i>Valvata cristata</i> | Flat valve snail | | | | | | 2 | | C |
| Erpobdellidae | <i>Erpobdella octoculata</i> | Leech | | | | 6 | | | | D |
| Glossiphoniidae | <i>Glossiphonia complanata</i> | Leech | | | | 4 | | | | D |
| Tubificidae | <i>Tubifex sp.</i> | Worm | | | | 64 | | | | E |
| Chironomidae | <i>Chironomus spp.</i> | Bloodworm | 100+ | 100+ | | | 61 | 4 | | E |
| Taxon Richness (n) | | | 8 | 10 | 9 | 8 | 3 | 5 | 9 | |
| Q-Rating | | | Q2-3 | Q2-3 | Q3 | Q2-3 | Q2¹ | Q2² | n/a³ | |
| WFD Status | | | Poor | Poor | Poor | Poor | Bad | Bad | n/a | |

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¹ Tentative Q-sample only (semi-stagnant site)

² Tentative Q-sample only (semi-stagnant site)

³ Q-samples do not apply to lentic/stillwater habitats

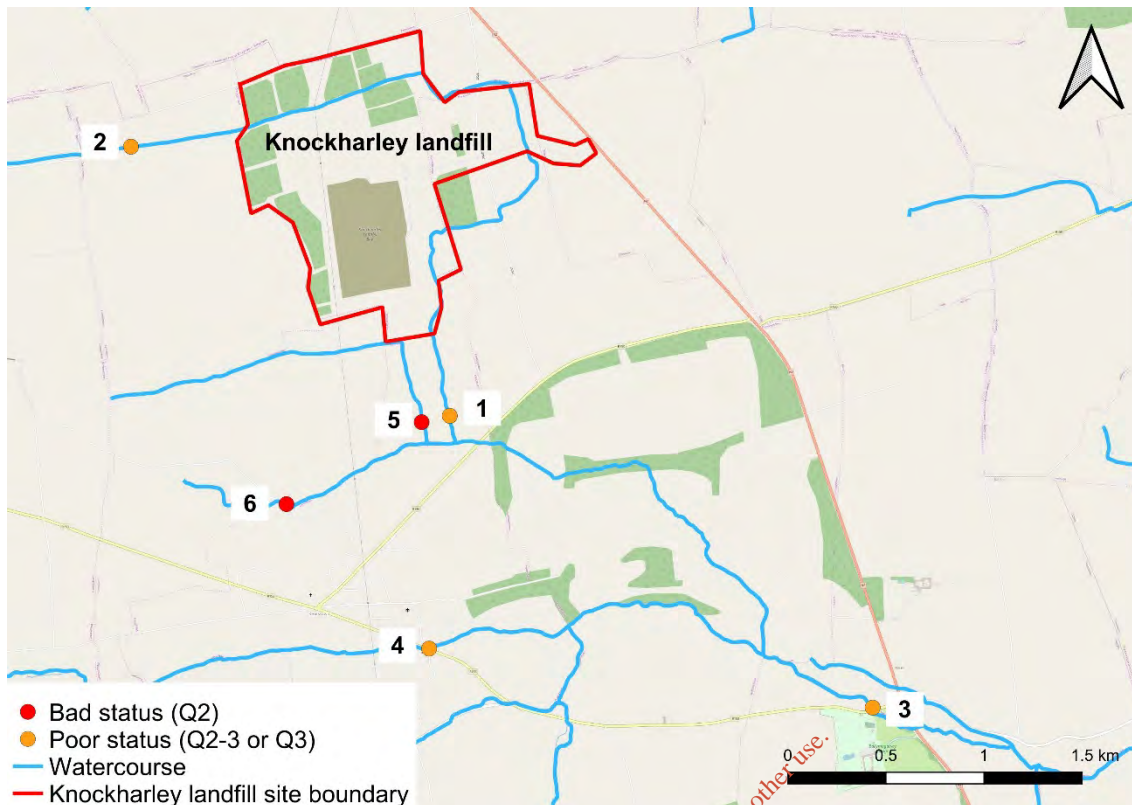


Figure 4.7 Water quality (WFD) status of the $n=6$ Q-sampling sites in the vicinity of Knockharley landfill.

Physio-chemical Water Quality

Physio-chemical water quality samples were collected and analysed from $n=6$ sites in the vicinity of Knockharley Landfill (see Figure 2.1). Samples were taken on 22nd August 2019. Table 4.5 provides a summary of physio-chemical results.

The pH, alkalinity and conductivity were relatively consistent across all sites sampled. Total ammonia levels fell within the levels defining good status waters (i.e. ≤ 0.065 mg N/l) under the European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 (S.I. 77 of 2019), for all survey sites with the exception of 2. The total ammonia levels of site 2 on the Flemingstown (Knockharley) Stream which is situated upstream of the landfill were substantially elevated at 0.118mg N/l and thus not achieving good status under the Surface Waters regulations (i.e. ≤ 0.06 mg N/l). As this site is situated upstream of the landfill the elevations in total ammonia cannot be associated with the existing landfill operations.

Levels of Total Oxidised Nitrogen (TON) (nitrate + nitrite in combination) were high across all sites. The Surface Water Regulations (S.I. 77 of 2019) sets no specific limits for nitrate however EPA assessment of high-quality water sources has set a limit of 0.8 mg/l $\text{NO}_3\text{-N}$ for high quality waters and 1.8 mg/l $\text{NO}_3\text{-N}$ for good quality waters. None of the $n=6$ sampling sites fell within the good quality class, with all samples containing TON of ≥ 1.068 mg N/l. Sites 3, 4 and 5 all exceeded >3.3 mg N/l, indicating

nutrient enrichment. The situation of the observed elevations of TON would indicate that they are not associated with the existing landfill operations (Figure 1.2 for sampling locations).

Nitrite typically accounts for <1% of the TON and, nitrate is the primary variable. The Quality of Salmonid Waters Regulations (S.I. No. 293/1988) sets levels of nitrite at <0.05mg NO₂/l for healthy salmonid habitat. Therefore, only sites 3 (River Nanny) and 5 (Kentstown Stream) fall below these limits, with all other sites >0.05mg NO₂/l. Site 6 on the Veldonstown Stream had particularly elevated levels of nitrites (0.16mg NO₂/l) as outlined Table 4.5. The situation of the observed elevations of Nitrite would indicate that they are not associated with the existing landfill operations (Figure 1.2 for sampling locations).

Molybdate Reactive Phosphorus (MRP) is essentially the amount of phosphorus bioavailable for plant uptake. Levels of MRP levels were consistent across all samples, with the highest levels recorded at sites 2 (Flemingstown (KnockharleyStream) and site 5 (Kentstown Stream), respectively as shown in Table 4.5. Unlike Total Phosphorus, the Surface Water Regulations (S.I. 77 of 2019) sets a target of ≤0.025 mg P/l (high status) and ≤0.035 mg P/l (good status) for rivers specifically. All samples failed to meet good status based on MRP levels, with all sites ≥0.100 mg P/l. As with elevated levels of Total Oxidised Nitrogen, this would indicate heavy enrichment or eutrophication.

Biochemical Oxygen Demand (BOD), for all sites was ≤1.4 mg/l O₂ with the exception of site 2 Flemingstown (Knockharley Stream) which had slightly higher levels of 2.6 mg/l O₂ see Table 4.5. The recorded BOD levels across the n=6 sites fell within acceptable limits for clean river water (i.e. ≤3 mg/l O₂). Similarly, values for Chemical Oxygen Demand were also relatively low across all sites with the exception of site 2 (i.e. 50.4 mg/l O₂), indicating lower levels of deoxygenating agents. The elevations at site 2 cannot be associated with existing landfill operations as it is situated upstream of the landfill.

Table 4.5 Physio-chemical water quality results for the survey sites in the vicinity of Knockharley Landfill, Co. Meath.

| Parameter | Site 1 | Site 2 | Site 3 | Site 4 | Site 5 | Site 6 |
|--------------------------------------|--------|--------|--------|--------|--------|--------|
| pH | 7.84 | 7.73 | 7.94 | 7.93 | 7.97 | 7.94 |
| Alkalinity (mg CaCO ₃ /l) | 232 | 220 | 283 | 268 | 282 | 310 |
| Conductivity (µS/cm) | 580 | 482 | 667 | 640 | 684 | 658 |
| Suspended solids (mg/l) | 10.6 | 9.8 | 4.2 | 4.4 | 6.8 | 6.4 |
| BOD (mg O ₂ /l) | 1.4 | 2.6 | 1.0 | 1.3 | 0.8 | 0.9 |

| Parameter | Site 1 | Site 2 | Site 3 | Site 4 | Site 5 | Site 6 |
|---|--------|--------|--------|--------|--------|--------|
| COD (mg O₂/l) | 32.5 | 50.4 | 21.5 | 27 | 21.9 | 18.3 |
| Total Oxidised Nitrogen (mg N/l) | 1.068 | 1.618 | 3.309 | 3.581 | 3.367 | 1.770 |
| Nitrite (mg NO₂/l) | 0.051 | 0.077 | 0.040 | 0.075 | 0.049 | 0.160 |
| Total Ammonia (mg N/l) | 0.033 | 0.118 | 0.032 | 0.031 | 0.030 | 0.024 |
| Unionised ammonia (mg N/l) | 0.001 | 0.003 | 0.001 | 0.001 | 0.001 | 0.001 |
| MRP (mg P/l) | 0.132 | 0.191 | 0.107 | 0.100 | 0.222 | 0.106 |

RHAT scores

The findings and calculations of the RHAT assessment carried out on 500m sections of watercourses in the vicinity of the landfill during August 2019 are presented in Appendix I. A graphic representation is provided in Figure 4.8.

Scores were calculated based on both banks of the river/stream in a given 500m section according to the criteria of channel morphology and flow types, channel vegetation, substrate diversity and condition, barriers to continuity, bank structure and stability, bank and bank top vegetation, riparian land use and floodplain interactions. Preliminary RHAT scores were calculated and converted to hydromorph scores in order to correspond to the widely used WFD classification scheme, i.e. High status (blue), Good status (green), Moderate status (yellow), Poor status (orange) and Bad status (red) (after Murphy & Toland, 2014).

Flemingstown (Knockharley) Stream

Much of the Flemingstown (Knockharley) Stream ranged from 'poor' to 'moderate' WFD status according to RHAT scores as shown in Figure 4.8 and outlined in, Table 4.6). This was largely reflective of the extensive historical straightening and deepening of the channel throughout, along with siltation and modified riparian land use pressures (e.g. coniferous plantations, arable crops, intensive agriculture). The worst score was recorded from the section adjoining the landfill boundary (FLE_08) although this was considered due to adjoining agricultural and livestock pressures rather than the operation of the existing landfill. Only a single 500m section on the Flemingstown (Knockharley) Stream (FLE_11), located outside of the landfill site, achieved the equivalent of 'good WFD status', largely given that the stream flowed through a block of mixed-broadleaved woodland. RHAT scores improved a considerable distance downstream of the landfill site boundary, notably downstream of the Kentstown Stream confluence.

Kentstown Stream

The Kentstown Stream was heavily modified, with extensive historical straightening and deepening of the channel throughout. It flowed through an intensive agricultural landscape and RHAT scores ranged from 'bad' to 'poor' as outlined in Table 4.7. Typically, scores decreased moving downstream towards the Flemingstown (Knockharley) Stream confluence, with the channel featuring an increasingly modified riparian zone, and a lack of vegetation and substrata diversity in addition to poor fisheries habitat overall and a lack of floodplain connectivity.

Veldonstown Stream

An 800 m section of the Veldonstown Stream was surveyed with both RHAT sections achieving 'poor' WFD status equivalent scores as outlined in Table 4.7. Like the Kentstown Stream, the Veldonstown flows through an intensive agricultural landscape, was heavily straightened and deepened, featured a lack of instream vegetation diversity, poor fisheries habitat and a lack of floodplain connectivity.

River Nanny

The RHAT scores on the River Nanny ranged from 'poor' to 'moderate', with no 500m section achieving a good WFD status equivalent score as outlined in Table 4.8. As with other watercourses in the vicinity of Knockharley Landfill, this score reflected the historically straightened and deepened nature of the channel, intensive agriculture uses to the bank top, often intermittent riparian vegetation, poor substrata diversity -often heavily silted, poor bank structure and stability (widespread livestock poaching) and poor floodplain interactions. However, some locally good overall fisheries habitat and retention of semi-natural profile was present in certain areas between sites 4 (East Bridge) and 3 (R153 Bridge) but overall the degree of naturalness along the River Nanny was poor.

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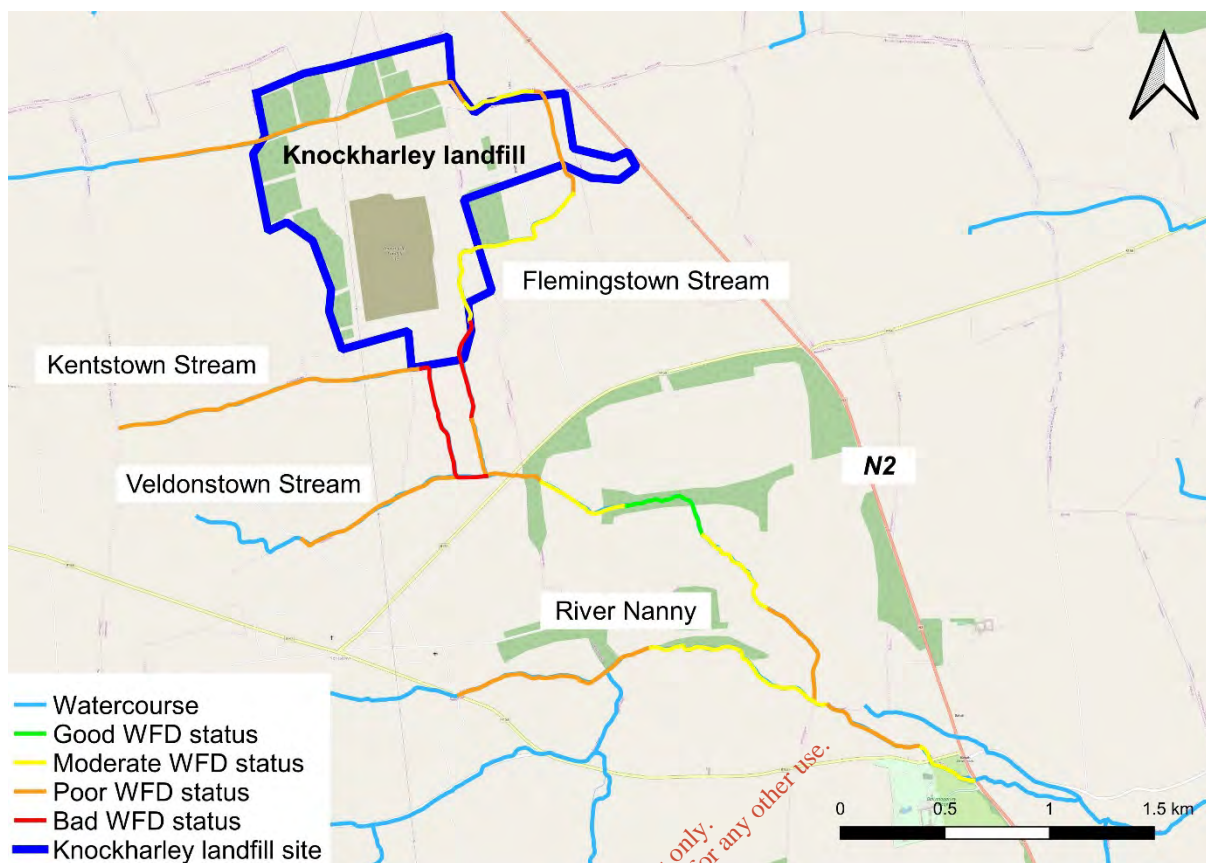


Figure 4.8 RHAT score distribution and WFD status equivalence for the watercourses in the vicinity of the Landfill.

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5. Discussion

5.1 Fisheries Habitat Evaluation (most and least valuable areas)

Salmonids

Repeat site visits on the 2nd and 22nd of August 2019, revealed that the salmonid habitat of the surveyed watercourses in the vicinity of Knockharley landfill was generally poor. Although the larger, downstream-connecting River Nanny offered superior salmonid habitat (good quality according to Life Cycle Unit scores, despite excessive siltation), those smaller watercourses in the vicinity of Knockharley Landfill offered poor quality conditions for salmonids (low flows, heavily silted, often heavily shaded and small in size).

The Flemingstown (Knockharley), Kentstown and Veldonstown Streams are subject to fluctuating water levels with rainfall events largely determining local flows. Low water levels (such as those experienced on the first site visit on 2nd August 2019) greatly reduce their capacity to support resident fish populations, with perhaps the exception of three-spined stickleback, a species highly tolerant of low dissolved oxygen, poor water quality and high stress environments (Ostlund-Nilsson et al., 2006). Q-sampling as shown in Table 4.4 and physiochemical water quality analysis as shown in Table 4.5 also indicated that these smaller watercourses were suffering from poor water quality issues, as identified in previous monitoring of the Knockharley Landfill site.

The salmonid habitat value was very low across the survey sites apart from in the River Nanny, where a range of brown trout age classes were recorded. Some locally good nursery and adult holding habitat was present at both sites 3 and 4 (outside of site boundary), with some locally good spawning substrata (gravels, smaller cobble) present at site 3. However, excessive siltation and substrata bedding reduced the salmonid spawning capacity of the river channel, as evident from the low densities of salmonid juveniles recorded via electro-fishing at sites 3 and 4 on the River Nanny. It has been shown that salmonid eggs laid in clean gravels which have subsequently been silted over have failed to hatch (Crisp, 1993, 2000) and siltation would, therefore, appear to be impacting salmonid populations in the River Nanny within the study area.

Lamprey

Lamprey potential (namely brook lamprey *Lampetra planeri* given the location of the sites) was poor overall when considering the physical condition of the watercourses and LHQI scores. Although some superior habitat was present on the River Nanny, the smaller watercourses (i.e. sites 1, 2, 5 and 6) were largely unsuitable for lamprey given the excessive siltation / compaction of potential spawning substrata and poor water quality (Q2 or Q2-3, as shown in Table 4.4. The seasonality and fluctuation of (often very low) flows also greatly reduced the lamprey potential of these smaller streams. In addition to an appropriate substrate, larval lamprey require a permanent unidirectional water flow to supply them with the proper nutrients, while promoting the exchange of respiratory gases and metabolic residues (Hardisty & Potter 1971; Ferreira et al., 2013).

Although sites 3 and 4 on the River Nanny offered greater lamprey potential in terms of finer, cleaner (localised) spawning gravels, the presence of optimal soft sediment for ammocoetes was sparse. Invariably such areas were compacted and not ideal for burrowing larvae. The majority of superficially suitable silt accumulations at site 3 (downstream of the bridge) were transient in nature, being mobilised downstream during higher water flows (as observed on 22nd August). Temporary, unstable habitat is not optimal for larval lamprey and this may reflect why none were recorded at this site. No records exist for lamprey species in the River Nanny (e.g. Kelly et al., 2013).

European Eel

Eel potential was poor across the survey sites, with some locally good habitat provided as sites 3 and 4 on the River Nanny. Diurnal refugia such as macrophyte growth, boulders, large cobble and large woody debris – features considered vital for eel (Laffaille et al., 2003) - were more frequent on the Nanny, as were superior foraging habitat and prey resources. The smaller watercourses offered little value to eel although some may be used as migratory routes during higher-flow periods.

Kingfisher

A single kingfisher was observed in flight on the Flemingstown (Knockharley) Stream during a walkover survey. Given the poor water quality and overgrown nature of the stream, the bird likely utilised the nearby existing surface water attenuation pond where broader prey resource existed (e.g. three-spined stickleback, macro-invertebrates, amphibians etc). Like the Kentstown and Veldonstown Stream, the Flemingstown supported three-spined stickleback locally but nevertheless offered poor water quality and poor overall fisheries potential, thus being less attractive to kingfisher. Although not recorded along the River Nanny, the river provided better foraging habitat in addition to a greater number of perches (for feeding) between sites 3 and 4. Overall the study area offered poor nesting potential for kingfisher given heavily scrubbed over banks with no nesting sites recorded during the walkover survey.

Otter

A low number of otter signs (spraint and prints) were recorded during site walkovers at sites 3 and 4 on the River Nanny, in addition to the existing surface water attenuation pond in the Knockharley landfill site. The more limited distribution of otter signs is consequential of the poor fisheries habitat and low prey resources present on the smaller Flemingstown, Kentstown and Veldonstown Streams. Although unlikely to be used regularly as foraging habitats, these watercourses are be utilised by commuting otter (i.e. evidence of movement along Knockharley Stream given known records). The existing surface water attenuation pond was evidently regularly used by otters (i.e. given the recorded regular sprainting site). This is likely due to the prey resource range present (i.e. stickleback, snails and small water birds) in addition to typically lower levels of human disturbance (site fenced-off). No holts were located during walkover surveys although several scrubbed-up areas near the lagoon offered good potential for otter breeding.

5.2 Water Quality

Q-Sampling

The biological water quality was of bad to poor status (Q2, Q2-3 or Q3) across all sampling sites and no sites achieved target good status Q4 water quality, as required under the Water Framework Directive (2000/60/EC). Site 3 located on the River Nanny approx. 3.6km downstream of the landfill boundary was the only site to achieve a Q3-rating -poor status, moderately polluted as outlined in Table 4.4 and Figure 4.7.

Whilst the results from sites 5 and 6 should be interpreted **tentatively** given the sub-optimal Q-sampling conditions (i.e. canalised channels with a lack of shallower riffles and predominating deep glides), the water quality results (Table 4.4) indicated that the watercourses in the vicinity of Knockharley landfill were suffering from local eutrophication (elevated nitrogen and phosphorus) as well as historical modification (poor quality physical habitat and flows).

Physio Chemical Sampling

Water quality across the $n=6$ sites was poor based on physiochemical water quality results with the exception of total ammonia, BOD and COD as outlined in Table 4.5. The watercourses are suffering from enrichment from nitrates and phosphorus (MRP), which was also reflected in the biological water quality sampling, see Table 4.4.

5.3 Conclusions

In summary, the watercourses within the vicinity of Knockharley landfill are generally of poor quality. This is expected for historically modified, straightened and or deepened channels with bordering intensive agricultural pressures. Siltation levels, for example, were evidently excessive on the River Nanny (sites 3 and 4) and this greatly reduced the fisheries potential, especially for salmonids. Biological water quality ranged from bad (Q2) to poor (Q2-3 or Q3) status and thus is not meeting target good status (Q4). The Knockharley study area was of lower overall value for kingfisher apart from transient foraging opportunities. Otter utilisation of watercourses in the vicinity of the landfill appeared to be low as only a small number of spraint sites were recorded. As with kingfisher these watercourses are likely only used for transient foraging. The findings of the aquatic surveys undertaken in 2019 outlined in this report are consistent with the findings of EIAR.

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Appendix I

RHAT scores

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Table I.1 RHAT scores for the surveyed reaches of the Flemingstown (Knockharley) Stream in the vicinity of Knockharley Landfill, Navan, Co. Meath. Each section corresponds to a 500m reach of channel

| Criteria | River section | | | | | | |
|---------------------------------|---------------|-----------|----------|-----------|------------|-------------|-----------|
| | FLE_01 | FLE_02 | FLE_03 | FLE_04 | FLE_05 | FLE_06 | FLE_07 |
| Channel morphology & flow types | 0 | 0 | 0 | 2 | 0 | 2 | 2 |
| Channel vegetation | 1 | 2 | 1 | 2 | 2 | 2 | 3 |
| Substrate diversity & condition | 2 | 2 | 1 | 2 | 1 | 1 | 1 |
| Barriers to continuity | 2 | 2 | 2 | 3 | 2 | 1 | 3 |
| Bank structure & stability | 2 | 2 | 2 | 2.5 | 1.5 | 2 | 3 |
| Bank & bank top vegetation | 3 | 1.5 | 1 | 3 | 1 | 2.5 | 3 |
| Riparian land use | 1 | 1.5 | 1 | 1.5 | 2 | 1 | 2 |
| Floodplain interactions | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 11 | 11 | 8 | 16 | 9.5 | 11.5 | 17 |
| Hydromorph score | 0.3 | 0.3 | 0.3 | 0.5 | 0.3 | 0.4 | 0.5 |
| WFD class | Poor | Poor | Poor | Moderate | Poor | Moderate | Moderate |

Table I.1 (continued) RHAT scores for the surveyed reaches of the Flemingstown (Knockharley) Stream in the vicinity of Knockharley Landfill, Navan, Co. Meath. Each section corresponds to a 500m reach of channel

| Criteria | River section | | | | | | |
|---------------------------------|---------------|----------|-----------|-----------|-----------|-----------|-----------|
| | FLE_08 | FLE_09 | FLE_10 | FLE_11 | FLE_12 | FLE_13 | FLE_14 |
| Channel morphology & flow types | 0 | 0 | 2 | 3 | 2 | 1 | 1 |
| Channel vegetation | 1 | 2 | 2 | 3 | 2 | 2 | 2 |
| Substrate diversity & condition | 0 | 0 | 1 | 3 | 2 | 2 | 2 |
| Barriers to continuity | 1 | 2 | 2 | 3 | 2 | 2 | 2 |
| Bank structure & stability | 2 | 2 | 2 | 3 | 1 | 1 | 1 |
| Bank & bank top vegetation | 2 | 2 | 2 | 3 | 1 | 1 | 1 |
| Riparian land use | 1 | 1 | 1 | 3 | 1 | 1 | 1 |
| Floodplain interactions | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 7 | 9 | 12 | 21 | 11 | 10 | 10 |
| Hydromorph score | 0.2 | 0.3 | 0.4 | 0.7 | 0.3 | 0.3 | 0.3 |
| WFD class | Bad | Poor | Moderate | Good | Poor | Poor | Poor |

Table I.1 (continued) RHAT scores for the surveyed reaches of the Kentstown Stream and Veldonstown Stream in the vicinity of Knockharley Landfill, Navan, Co. Meath. Each section corresponds to a 500m reach of channel

| Criteria | River section | | | | | VEL_01 | VEL_02 |
|---------------------------------|---------------|-----------|-----------|------------|----------|----------|-----------|
| | KEN_01 | KEN_02 | KEN_03 | KEN_04 | KEN_05 | | |
| Channel morphology & flow types | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Channel vegetation | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| Substrate diversity & condition | 2 | 2 | 1 | 1 | 0 | 2 | 2 |
| Barriers to continuity | 1 | 1 | 1 | 0 | 0 | 1 | 2 |
| Bank structure & stability | 2 | 2 | 2 | 1.5 | 1 | 2 | 2 |
| Bank & bank top vegetation | 3 | 3 | 3 | 1 | 1 | 2 | 2 |
| Riparian land use | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Floodplain interactions | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 11 | 11 | 10 | 5.5 | 4 | 9 | 10 |
| Hydromorph score | 0.3 | 0.3 | 0.3 | 0.2 | 0.1 | 0.3 | 0.3 |
| WFD class | Poor | Poor | Poor | Bad | Bad | Poor | Poor |

Table I.1 (continued) RHAT scores for the surveyed reaches of the River Nanny in the vicinity of Knockharley Landfill, Navan, Co. Meath. Each section corresponds to a 500m reach of channel

| Criteria | River section | | | | | |
|---------------------------------|---------------|-----------|-------------|-----------|-----------|-------------|
| | NAN_01 | NAN_02 | NAN_03 | NAN_04 | NAN_05 | NAN_06 |
| Channel morphology & flow types | 1 | 1 | 3 | 1 | 1 | 1 |
| Channel vegetation | 2 | 2 | 2 | 3 | 3 | 3 |
| Substrate diversity & condition | 0 | 0 | 1 | 2 | 2 | 0 |
| Barriers to continuity | 3 | 3 | 3 | 3 | 3 | 3 |
| Bank structure & stability | 2 | 2 | 2 | 2 | 0 | 3 |
| Bank & bank top vegetation | 2 | 2 | 2.5 | 2 | 1 | 3 |
| Riparian land use | 1 | 1 | 2 | 1 | 0 | 2.5 |
| Floodplain interactions | 0 | 0 | 0 | 0 | 1 | 1 |
| Total | 11 | 11 | 15.5 | 13 | 10 | 15.5 |
| Hydromorph score | 0.3 | 0.3 | 0.5 | 0.4 | 0.3 | 0.5 |
| WFD class | Poor | Poor | Moderate | Moderate | Poor | Moderate |



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Triturus Environmental Ltd.,

42 Norwood Court,

Rochestown,

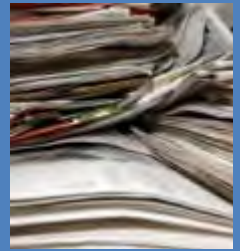
Co. Cork.

Appendix 3

Bird Survey Report

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KNOCKHARLEY LANDFILL BIRD SURVEY 2018/19

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CREATED FOR:

Knockharley Landfill Ltd.



CREATED:

October 2019

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1 INTRODUCTION

This report details the results of bird surveys carried out at Knockharley Landfill during 2018/19 and 2019. This survey was undertaken to continue the ongoing environmental works at the existing landfill in accordance with 2014 EIA Directive 2014/52/EU. This report should be read in conjunction with Chapter 10 of the EIAR.

Knockharley Landfill Ltd proposes to further develop the existing facility. In addition to desktop study, an extensive field-based assessment was carried out within the boundary of the entire facility. The surveys were carried out to examine the potential impact of the proposed development on avian species.

The following surveys were undertaken in the winter of 2018/19 and summer of 2019:

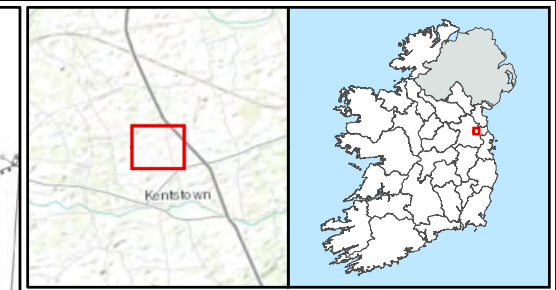
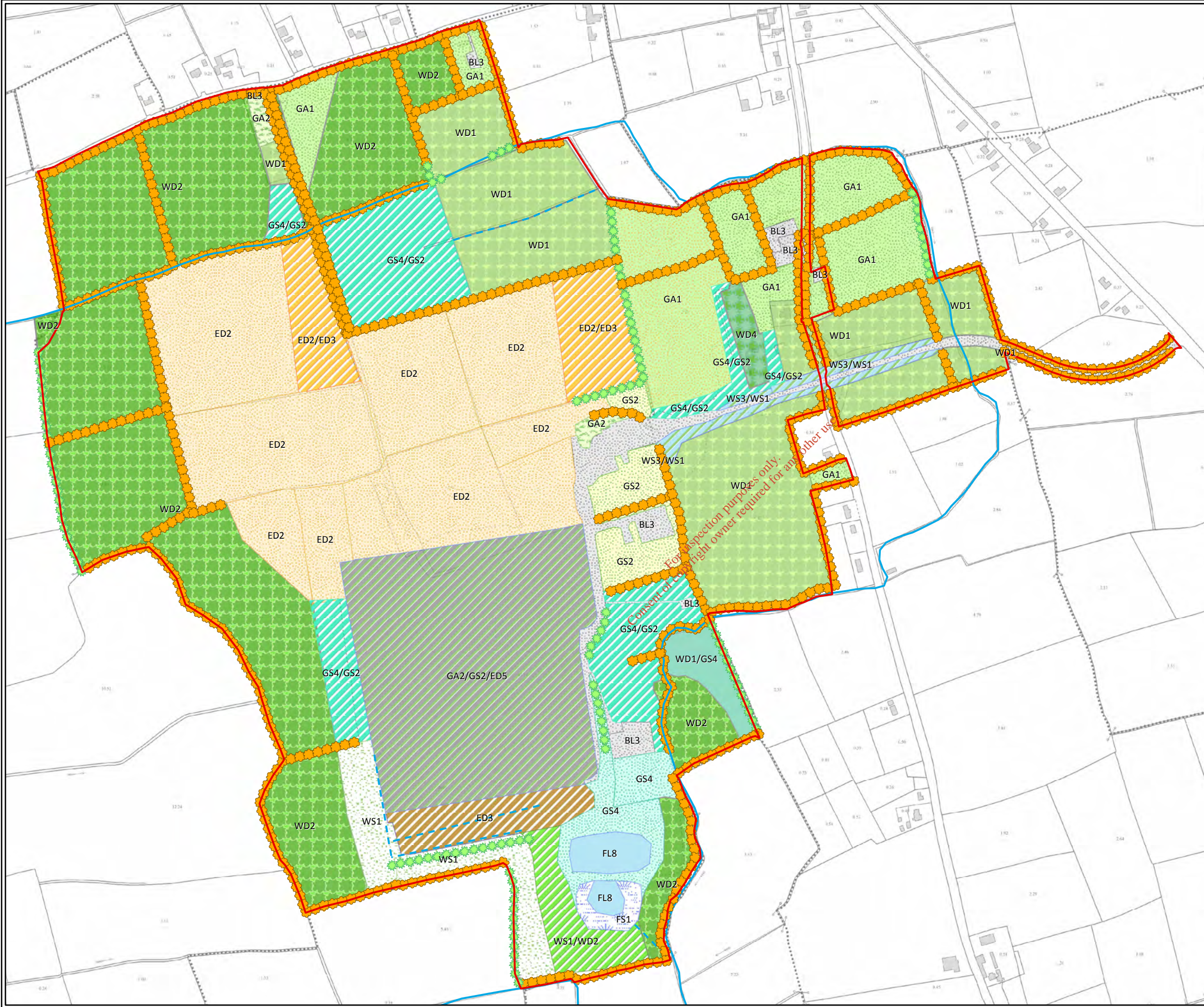
- Winter Bird Transect Survey
- Summer Bird Transect Survey
- Breeding Raptor Survey
- Raptor Vantage Point Survey
- Breeding Wader Survey
- Kingfisher Survey
- Barn Owl Survey

1.1 Habitats within the facility

The following habitats, classified according to Fossitt (2000), are located within the proposed development:

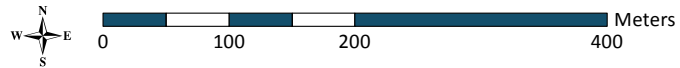
- Improved Agricultural Grassland (GA1)
- Wet Grassland/Dry Meadows and Grassy Verges (GS4/GS2) Mosaic
- Dry Meadows and Grassy Verges (GS2)
- Wet Grassland (GS4)
- Hedgerows (WL1)
- Treelines (WL2)
- (Mixed) Broadleaved woodland (WD1)
- (Mixed) Broadleaved Woodland/Wet Grassland (WD1/GS4) Mosaic
- Conifer Plantation (WD4)
- Mixed Broadleaved/Conifer Woodland (WD2)
- Buildings and Artificial Surfaces (BL1)
- Spoil and Bare Ground (ED2)
- Recolonising Bare Ground (ED3)
- Spoil and Bare Ground/Recolonising Bare Ground (ED2/ED3) Mosaic
- Scrub (WS1)
- Ornamental/Non-native Shrub/Scrub (WS3/WS1) Mosaic
- Drainage Ditches (FW 4)
- Eroding Rivers (FW 1)
- Artificial Lakes and Ponds (FL8)
- Reed and Large Sedge Swamps (FS1)

Figure 1 below illustrates the habitats and their coverage at the facility.



- Planning Boundary
- Habitat**
- FW1 - eroding river
- FW4 - drainage ditches
- WL1 - hedgerow
- WL2 - treeline
- BL3 - buildings and artificial surfaces
- ED2 - spoil and bare ground
- ED2 / ED3 - spoil and bare ground / recolonising bare ground mosaic
- ED3 - recolonising bare ground
- FL8 - artificial lakes and ponds
- FS1 - reed and large sedge swamps
- GA1 - improved agricultural grassland
- GA1 / GS4 - improved agricultural grassland / wet grassland mosaic
- GA2 - Amenity
- GA2/GS2/ED5 - amenity grassland / dry meadows and grassy verges / refuse and other waste
- GS2 - dry meadows and grassy verges
- GS4 - wet grassland
- GS4 / GS2 - wet grassland / dry meadows and grassy verges mosaic
- WD1 - (mixed) broadleaved woodland
- WD1 / GS4 - (mixed) broadleaved woodland / wet grassland mosaic
- WD2 - mixed broadleaved / conifer woodland
- WD4 - Conifer Plantation
- WS1 - scrub
- WS1 / WD2 - scrub / mixed broadleaved-conifer woodland mosaic
- WS3 / WS1 - ornamental/non-native shrub / scrub mosaic

| | |
|--------------------|---------------------------------|
| TITLE: | Habitats |
| PROJECT: | Knockharley Landfill, Co. Meath |
| FIGURE NO.: | 1 |
| CLIENT: | Knockharley Landfill Ltd. |
| SCALE: | 1:6000 |
| REVISION: | 0 |
| DATE: | 21/10/2019 |
| PAGE SIZE: | A3 |



2 METHODOLOGY

2.1 Desktop Study

A desktop study was carried out to collate and review available information, datasets and documentation sources pertaining to the facility's natural environment. It involved an examination of birds recorded within the 10 km grid square in which the existing facility is located using the National Biodiversity Data Centre (NDBC) mapping system (<http://maps.biodiversityireland.ie/#/Map>) and information on the National Parks and Wildlife Service (NPWS) webpage, metadata available online from the NPWS mapping system (<http://webgis.npws.ie/npwsviewer/>). These databases were accessed on the 8th October 2019.

A data request for rare and protected species within 10 km of the existing facility was submitted to the NPWS on 8th October 2019. A response was received on the 11th October 2019 and the information received used within this report.

2.2 EIAR Surveys

Breeding bird surveys following Bibby *et al.* (2000) were previously undertaken on 5th and 6th May 2010 and 26th March 2015 and 8th July 2016. Winter transects following the same methodology were undertaken on 16th December 2015 and 29th January 2016. Both sets of transect surveys were to inform EIAR preparation.

As per section 10.3.6 of the EIAR:

"Breeding birds at the site were previously surveyed using a series of survey transects on the 5th and 6th of May 2010 (Bibby et al., 2000) (FT, 2010). A total of five transects of approximately 800 m in length were walked during the survey visits (See Figure 10-1). A minimum distance of 250 m was allowed between transects to minimise double-counting of individual birds across the site.

Any additional bird species encountered at the site but outside of the dedicated surveys were also noted. All species encountered (seen or heard) within 100 m of the observer were recorded and their abundance was noted. All species occurring more than 100 m from the observer or flying were not included in the abundance analysis, but were recorded as 'additional' species for separate analysis. The total number of birds per species was derived by adding abundance data from all transects. This allowed a measure of relative abundance to be examined for all breeding bird species recorded.

The above transects were repeated for the current evaluation on 26th March 2015 and 8th July 2016; primarily to determine whether any changes to the existing environment in the interim since the commencement of operation had led to changes in the suite of avifauna present, and/or likely to be affected by the proposed development. Transects were repeated as in the 2010 survey, apart from slight amendments to T1 and T5 due to the presence of security fencing which prevented the original route from being followed. In this manner, a taxa list of the birds present in the area and their relative abundance could be generated.

Winter transects were also carried out on the 16th December 2015, 29th January 2016 and 16th November 2018 and the results are included in this document. Two further winter bird surveys will be carried out in December 2018 and January 2019.

The conservation status of each bird species recorded by this study was assessed. 'Birds of Conservation Concern in Ireland' (BoCCI) are classified into three separate lists; Red-listed species are of high conservation concern, Amber-listed species are of medium conservation concern and Green-listed species are considered to be of no conservation concern (see Colhouns & Cummins 2013). The conservation status of the bird species found by this study was also assessed by reviewing if species recorded at the site are listed on Annex I on the EU Birds Directive (2009/147/EC). These species are afforded additional protection through the designation of Special Protection Areas (SPAs) throughout EU countries. Again, it should be noted that, an appraisal of the potential impacts of the proposed development on the constitutive characteristics of European sites within 15km of the proposed development at the Knockharley landfill is set out in the AA Screening Statement and Natura Impact Statement which accompany this application for permission."

2.3 2018/19 Surveys

Bird surveys were carried out on the following dates within the existing facility (Figure 2):

Table 2-1: Winter 2018 and Summer 2019 Bird Survey Details

| Date; Start - End time | Surveys | Weather Conditions | Surveyor |
|---|--|---|--|
| 12 th December 2018; 08:45 - 11:45 | Winter Bird Transect Survey | Dull, overcast, Wind West F-1. Visibility excellent | Dr. Jonathon Dunn, MA (Cantab.), MSc and PhD (Avian Ecology) |
| 25 th January 2019; 08:50 - 11:35 | Winter Bird Transect Survey | Overcast, but clear. Cloud 7/8. Visibility excellent | Dr. Jonathon Dunn, MA (Cantab.), MSc and PhD (Avian Ecology) |
| 15 th May 2019; 08:40 - 12:00 | Summer Bird Transect Survey. | Mild, Wind southeast F-2. Cloud 6/8. Visibility excellent | Dr. Jonathon Dunn, MA (Cantab.), MSc and PhD (Avian Ecology) |
| 14 th June 2019; 07:00 - 13:00 | Breeding Wader Survey, Kingfisher Survey, Barn Owl Survey | Dull, humid. Wind west F-2. Cloud 8/8 | Dr. Jonathon Dunn, MA (Cantab.), MSc and PhD (Avian Ecology) |
| 21 st June 2019; 07:00 - 16:00 | Breeding Wader Survey, Raptor Vantage Point Survey, Kingfisher Survey | Bright, calm, sunny. 16 degrees. Wind Southwest, F2-3. Cloud 2/8. Visibility excellent | Joseph Adamson M.Sc, MCIEEM |
| 8 th July 2019; 07:00 - 16:00 | Breeding Wader Survey, Raptor Vantage Point Survey, Kingfisher Survey, Barn Owl Survey | Dull, overcast, mild. 19 degrees. Humid. Wind East-southeast <F -1. Cloud 8/8. Visibility excellent | Joseph Adamson M.Sc, MCIEEM |
| 7 th August 2019; 07:00 - 16:00 | Raptor Vantage Point Survey, Kingfisher Survey | Bright, but overcast at times. 21 degrees. Occasional shower. Wind southwest F-2-3. Cloud 8/8. Visibility excellent | Joseph Adamson M.Sc, MCIEEM |

2.4 Breeding Wader Survey

A breeding wader survey was carried out at the facility, to evaluate the existing facility for the potential for breeding waders such as Curlew *Numenius arquata*, Lapwing *Vanellus vanellus* and Snipe *Gallinago gallinago*.

Three site visits were carried out on 14th and 21st June 2019 and 8th July 2019. The survey methodology followed O'Brien and Smith (1992) from Gilbert *et al* (1998).

The surveys were carried out within three hours after dawn and all potential breeding habitat areas were surveyed, including the agricultural grasslands at the north and northeast of the facility, the wet grassland area at the southeast of the facility, the surface water attenuation pond at the south of the facility and the grassed over landfill area at the centre of the facility. Nikon Monarch M511 8x42 binoculars were used.

2.5 Breeding Raptor Vantage Point Survey

A breeding raptor survey was carried out at the facility during the summer of 2019 and the methodology followed Hardey *et al.* (2006). A raptor vantage point survey was carried out on 21st June 2019, 7th July 2019 and the 8th August 2019. Target breeding raptors within the facility included Buzzard *Buteo*, Sparrowhawk *Accipiter nisus* and Kestrel *Falco tinnunculus*, species that may breed within the facility.

The raptor vantage point survey entailed watching from a fixed vantage point, for a duration of six hours, during each visit. The grassed over landfill at the centre of the facility was deemed a suitable vantage point as it was elevated and offered the observer a 180-degree panoramic view of the entire facility and beyond. This afforded a constant view that could be monitored. The vantage point was located at E97351 N67073 on the landfill. In addition to Zeiss 7x42 binoculars, a Swarovski 20-60x60 HD Telescope was used for the vantage point survey. If raptors were observed, their flight height, duration of the sighting and behaviour was noted.

2.6 Kingfisher Survey

A survey of watercourses and standing water at the facility was conducted, in order to detect the presence of breeding Kingfisher *Alcedo atthis* within the facility. Kingfisher surveys were carried out on 14th and 21st June 2019; and 8th July 2019 and 7th August 2019. The methodology followed NRA Guidelines (NRA 2009) and an assessment was carried out of water features and associated habitats for foraging, nesting and roosting Kingfishers. Watercourses and standing water at the facility included the following (Figure 2):

- A = Small stream (Fossitt code FW1; eroding river) with some partly near bird transect survey TR-2
- P1 = Surface water attenuation pond (Fossitt code FL8; artificial lakes and ponds) near start of TR-2
- P2 = Surface water attenuation pond and overflow pond (Fossitt code FL8; artificial lakes and ponds) at the south of the facility
- B = Drainage ditch (Fossitt code FW4; drainage ditches) near TR-3
- C = Small stream (Fossitt code FW1; eroding river) near TR-4
- E = Drainage ditch (Fossitt code FW4; drainage ditches) near TR-5

Nikon Monarch M511 8x42 binoculars were used.

Note that a separate Kingfisher survey was undertaken as part of the aquatic surveys (Triturus, 2019). A full description of this methodology is provided in the companion report. Briefly, vantage point surveys were undertaken at four locations both within the existing facility and the surrounding environs on 02/08/2019 and 22/08/2019.

2.7 Transect Surveys

2.7.1 Winter Bird Survey

A winter bird survey was carried out on two dates during the winter of 2018/19 (a previous survey was carried out on 16/11/2018 already included in the EIAR). Five transects were chosen, which afforded coverage of all the habitats present throughout the facility. As for previous surveys, the transect route was divided into band widths and recorded species within these band widths following Bibby *et al.* (2000). This is the methodology used by BirdWatch Ireland when carrying out annual Countryside Bird Surveys to monitor long-term breeding bird population fluctuations within the Republic of Ireland. The survey entails walking the centre line of the transect and recording species observed or heard at 0-25 m, 25-50 m and 50-100 m band widths.

For each date, the total number of a particular species recorded from all five transects were collated so, for example, four Blackbirds recorded on 12/12/18 was the sum total observed or heard from all five transects in the facility, on that date. Nikon Monarch M511 8x42 binoculars were used. No recording equipment was used.

Winter bird surveys were carried out on the following dates: 12/12/18 and 25/01/19.

Descriptions of the transect routes and their location are as follows:

Transect 1 (TR-1)

This transect is located at the northeast of the facility and starts at the offices and car park at the entrance. It includes the roadside entering the facility, improved agricultural grassland (GA1) adjacent to (mixed) broadleaved woodland (WD1), ornamental/non-native shrub / scrub mosaic (WS3/WS1) and farm buildings. Thus, woodland was included in the buffer zones for each transect and was surveyed. See Figure 2.

Transect 2 (TR-2)

This transect is located at the east of the facility and starts at the northern surface water attenuation pond (artificial lakes and ponds; FL8). This pond is lined with a LDPE polymer cover and is quite shallow. The transect runs through a vegetated track and then enters an open area of wet grassland / dry meadows and grassy verges (GS4 / GS2) mosaic, where a derelict shed is located. This shed was used in the past to keep birds of prey, which were used in the facility to deter corvids and gulls on the landfill area. The transect affords a view of the grassed-over landfill (amenity grassland/dry meadows and grassy verges/refuse and other waste mosaic; GA2/GS2/ED5) to the west. The transect runs immediately adjacent to (mixed) broadleaved woodland (WD1) and mixed broadleaved / conifer woodland (WD2). Thus, woodland was included in the buffer zones for each transect and was surveyed.

This transect then passes the Landfill Gas Compound and runs in a south-westerly direction over wet grassland (GS4) and includes the southern surface water attenuation pond (artificial lakes and ponds; FL8) and the wetland (reed and large sedge swamps; FS1) that has developed from overflow of this attenuation pond. This attenuation pond is lined with a similar substrate to the northern pond. The pond is essentially an Integrated Constructed Wetland. The wetland is dominated by Common Reed *Phragmites australis* with some Bullrush *Typha latifolia* with standing water. The transect then runs in a northerly and then a westerly direction along a track between a high berm to the south and the grassed-over landfill (amenity grassland/dry meadows and grassy verges/refuse and other waste mosaic; GA2/GS2/ED5) to the north. It ends at the southwest corner of the grassed-over landfill (Figure 2).

Transect 3 (TR-3)

This transect runs in a northerly direction to the west of the grassed-over landfill (amenity grassland/dry meadows and grassy verges/refuse and other waste mosaic; GA2/GS2/ED5) and is immediately adjacent to mixed broadleaved / conifer woodland (WD2), further west. Thus, woodland was included in the buffer zones for each transect and was surveyed. The transect then travels close to the area of active landfill operations, over excavated soil (spoil and bare ground; ED2), where the majority of gulls and corvids congregate within the facility. The transect affords views of agricultural land to the west, outside of the facility, and the active landfill area and the proposed leachate cells (Figure 2).

Transect 4 (TR-4)

This transect is located at the northeast of the facility and runs in a northerly and then an easterly direction over spoil and bare ground (ED2) and spoil and bare ground / recolonising bare ground mosaic (ED2 / ED3). The transect is immediately adjacent to the edges of mixed broadleaved / conifer woodland (WD2) and a wet grassland / dry meadows and grassy verges mosaic (GS4/GS2). Thus, woodland was included in the buffer zones for each transect and was surveyed (Figure 2).

Transect 5 (TR-5)

This transect is located to the north of TR-1 and covers improved agricultural grassland (GA1), hedgerows (WL1) and treelines (WL2). It ends in a (mixed) broadleaved woodland (WD1) plantation (Figure 2). Thus, woodland was included in the buffer zones for each transect and was surveyed.

2.7.2 Summer Bird Survey

The summer bird survey was carried out over four dates during the summer of 2019. Dates surveyed are as follows: 15/5/2019 and 21/6/2019. The transects selected and the methodology used was identical to the winter bird survey.

The breeding status categories of species was defined i.e. non-breeding, possibly breeding, probably breeding, confirmed breeding as outlined in Balmer et al. (2013) and the BTO breeding bird classification as shown below in Plate 1.

| Non-breeding | |
|---------------------------|--|
| F | Flying over |
| M | Species observed but suspected to be still on M igration |
| U | Species observed but suspected to be s Ummering non-breeder |
| Possible breeder | |
| H | Species observed in breeding season in suitable nesting H abitat |
| S | Singing male present (or breeding calls heard) in breeding season in suitable breeding habitat |
| Probable breeding | |
| P | Pair observed in suitable nesting habitat in breeding season |
| T | Permanent T erritory presumed through registration of territorial behaviour (song etc) on at least two different days a week or more part at the same place or many individuals on one day |
| D | Courtship and D isplay (judged to be in or near potential breeding habitat; be cautious with wildfowl) |
| N | Visiting probable N est site |
| A | A gitated behaviour or anxiety calls from adults suggesting probable presence of nest or young nearby |
| I | Brood patch on adult examined in the hand suggesting I ncubation |
| B | Nest B uilding or excavating nest-hole |
| Confirmed breeding | |
| DD | D istraction- D isplay or injury feigning |
| UN | U sed N est or eggshells found (occupied or laid within period of survey) |
| FL | Recently F Ledged young (nidicolous species) or downy young (nidifugous species). Careful consideration should be given to the likely provenance of any fledged juvenile capable of significant geographical movement. Evidence of dependency on adults (e.g. feeding) is helpful. Be cautious, even if the record comes from suitable habitat. |
| ON | Adults entering or leaving nest-site in circumstances indicating O ccupied N est (including high nests or nest holes, the contents of which can not be seen) or adults seen incubating |
| FF | Adult carrying F aecal sac or F ood for young |
| NE | N est containing E ggs |
| NY | N est with Y oung seen or heard |

Plate 1: BTO Classifications

2.8 Barn Owl Survey

A Barn Owl survey was carried out at the facility on the 14th June and 8th July 2019. The methodology followed Gilbert *et al.* (1998) and NRA Guidelines (2009). The existing facility was searched for field signs, including pellets, droppings and feathers. The facility was searched for old hollow trees, nest boxes that may have been erected and old buildings. Nikon Monarch M511 8x42 binoculars were used. The June visit was conducted to locate active nests with eggs, if any, and the July visit, to check for fledged young and late nests.

The entire study area was checked for the presence of Barn Owls with special attention given to selected areas such as the farm buildings at the northeast of the existing facility.

2.9 Impact Assessment

EPA Guidelines (2017) were used to assess the potential impact and resulting effect of the proposed development on avian resources.

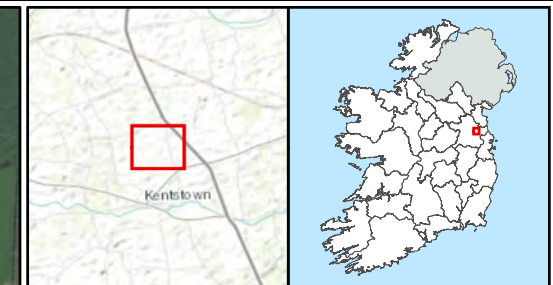
In line with the EPA Guidelines (EPA, 2017), the following terms are defined when quantifying duration:

- Momentary: from seconds to minutes
- Brief: up to 1 day
- Temporary: up to 1 year
- Short-term: from 1-7 years;
- Medium-term: 7-15 years;
- Long-term: 15-60 years; and
- Permanent: over 60 years.

The impacts were assessed under a number of parameters such as magnitude, extent, timing, frequency, duration and reversibility. The impact significance criteria (EPA, 2017) as set out in Table 2 are used where applicable. A glossary of impacts is further outlined in Appendix 10.3 Volume 3 of the EIAR.

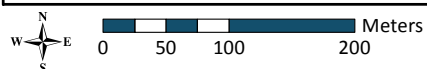
Table 2-2: Significance of Effects Criteria

| Impact Significance | Criteria |
|---------------------|--|
| Imperceptible | An effect capable of measurement but without significant consequences |
| Not significant | An effect which causes noticeable changes in the character of the environment but without significant consequences |
| Slight | An effect which causes noticeable changes in the character of the environment without affecting its sensitivities |
| Moderate | An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends |
| Significant | An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment |
| Very significant | An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment |
| Profound | An effect which obliterates sensitive characteristics |



- Planning Boundary
 - Linear Waterbodies
 - Ponds
 - Bird Survey Transects
- Note: P1 is a covered attenuation pond

| | | | |
|--------------------|---------------------------------|--|----|
| TITLE: | Bird Survey 2018/19 | | |
| PROJECT: | Knockharley Landfill, Co. Meath | | |
| FIGURE NO.: | 2 | | |
| CLIENT: | Knockharley Landfill Ltd. | | |
| SCALE: | 1:6000 | REVISION: | 0 |
| DATE: | 24/10/2019 | PAGE SIZE: | A3 |
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3 RESULTS

3.1 Desktop Survey

A desktop review of information available from the National Biodiversity Data Centre (NBDC) and NPWS showed that 34 rare/threatened and/or protected bird species have been recorded historically within the 10 km grid square (N96) in which the existing facility is located (see Table 3)¹. Only up-to-date records (made since 2009) have been included.

Table 3-1: Desktop results of rare/threatened and/or protected bird species recorded since 2009 within the 10 km of the existing facility

| Common Name (<i>Scientific name</i>) | Birds Directive | Conservation Status | Wildlife Acts |
|---|-------------------|---------------------|---------------|
| Barn Owl (<i>Tyto alba</i>) | No | Red | Yes |
| Barn Swallow (<i>Hirundo rustica</i>) | No | Amber | Yes |
| Black-headed Gull (<i>Larus ridibundus</i>) | No | Red | Yes |
| Common Coot (<i>Fulica atra</i>) | Annex II & III | Amber | Yes |
| Common Kestrel (<i>Falco tinnunculus</i>) | No | Amber | Yes |
| Common Kingfisher (<i>Alcedo atthis</i>) | Annex I | Amber | Yes |
| Common Linnet (<i>Carduelis cannabina</i>) | No | Amber | Yes |
| Common Pheasant (<i>Phasianus colchicus</i>) | Annex II & III | Green | Yes |
| Common Sandpiper* (<i>Actitis hypoleucos</i>) | No | Amber | Yes |
| Common Snipe (<i>Gallinago gallinago</i>) | Annex II & III | Amber | Yes |
| Common Starling (<i>Sturnus vulgaris</i>) | No | Amber | Yes |
| Common Swift (<i>Apus apus</i>) | No | Amber | Yes |
| Common Wood Pigeon (<i>Columba palumbus</i>) | Annex II & III | Green | Yes |
| Cormorant (<i>Phalacrocorax carbo</i>) | No | Amber | Yes |
| Eurasian Tree Sparrow (<i>Passer montanus</i>) | No | Amber | Yes |
| Eurasian Woodcock (<i>Scolopax rusticola</i>) | Annex II & III | Red | Yes |
| European Golden Plover (<i>Pluvialis apricaria</i>) | Annex I, II & III | Red | Yes |
| Grey Heron* (<i>Ardea cinerea</i>) | No | Green | Yes |
| Herring Gull (<i>Larus argentatus</i>) | No | Red | Yes |
| House Martin (<i>Delichon urbicum</i>) | No | Amber | Yes |
| House Sparrow (<i>Passer domesticus</i>) | No | Amber | Yes |
| Mallard (<i>Anas platyrhynchos</i>) | Annex II & III | Green | Yes |
| Mew Gull (<i>Larus canus</i>) | No | Amber | Yes |
| Moorhen* (<i>Gallinula chloropus</i>) | No | Green | Yes |
| Mute Swan (<i>Cygnus olor</i>) | No | Amber | Yes |

¹ Data were accessed from NBDC on 08/10/2019 and the data request received from NPWS on 11/10/2019

| Common Name (<i>Scientific name</i>) | Birds Directive | Conservation Status | Wildlife Acts |
|---|-----------------|---------------------|---------------|
| Northern Lapwing (<i>Vanellus vanellus</i>) | Annex II | Red | Yes |
| Peregrine Falcon (<i>Falco peregrinus</i>) | Annex I | Green | Yes |
| Ringed Plover (<i>Charadrius hiaticula</i>) | No | Green | Yes |
| Rock Pigeon (<i>Columba livia</i>) | Annex II | Green | Yes |
| Sand Martin* (<i>Riparia riparia</i>) | No | Amber | Yes |
| Skylark (<i>Alauda arvensis</i>) | No | Amber | Yes |
| Spotted Flycatcher (<i>Muscicapa striata</i>) | No | Amber | Yes |
| Whooper Swan (<i>Cygnus cygnus</i>) | Annex I | Amber | Yes |
| Yellowhammer (<i>Emberiza citrinella</i>) | No | Red | Yes |

3.2 EIAR Surveys

In the following section, the results from bird surveys shown in the EIAR in section 10.4.6 are included verbatim (with grey background and original numbering).

10.4.6 Birds in the existing environment

A total of 24 bird species were recorded during avian surveys at the existing facility in 2010 (FT, 2010). A further two species were recorded in March 2015 and a further nine species in 2016. Table 10-9 shows the total number of birds recorded on all five avian transects in 2010, 2015 and 2016, and their conservation status following the most recent Birds of Conservation Concern in Ireland (BOCCI) list (Colhoun & Cummins 2013). Additional species observed during the surveys is detailed in Table 10-10.

Results of 2010 Survey

The most abundant species recorded during avian surveys were Woodpigeon, Wren, Goldfinch and Willow Warbler (9-10 records each). Skylark and Blackbird were also abundant on the site and these species were recorded on all five of the avian transects. All avian species were recorded on a minimum of two transects. Many of the species were associated with field boundaries, however the immature forestry also provides cover for many species.

Two Buzzards were recorded on the site on both of the surveys days and a third Buzzard was also recorded on the second survey day. Buzzards were recorded on transects 4 and 5 only. This species was observed flying over the northern area of the site and a roost site was located in a mature tree in the north of the site.

It is possible that this species nests in the vicinity of the roost site and the birds became very vocal when the roost tree was approached.

No evidence of a nest could be seen however and the presence of a third bird may indicate that these could be non-breeding birds. This species is regularly observed by site staff to the north of the site. Buzzards were not recorded on the site during previous surveys (Celtic waste, 2000, Greenstar, 2008), although it was observed in the wider landscape.

Figure 10-1 shows the location of the avian transects (2010, 2015 and 2016) and Appendix 10.2 Volume 3 of this EIAR gives the locations and habitats occurring on each transect. The habitats surveyed by all transects were similar, being dominated by a mosaic of wet grassland and improved agricultural grassland as well as immature woodland. Transects 2, 4 and 5 were located adjacent to field boundaries, including either hedgerows or treelines.

Avian species richness was highest on transect 5 (16 species) followed by transects 1 and 4 (15 species). Avian species richness was lowest (7 species) on transect 2, which was located to the east of the existing landfill site. It should be noted that a number of additional species were recorded flying over this area towards the landfill site (i.e. Rook and Jackdaw).

Disturbance was higher in this area than on the other transects due to human and vehicular activity and this may have contributed to the low number of species recorded here. Furthermore, the areas of improved agricultural grassland here provide little cover and/or food for birds.

A pair of Coots appear to be breeding on the constructed wetland in the south of the site and a Mallard was also seen flying over this area. Two Grey Heron were seen flying over the site in the northern area of the site and Hooded Crow were only recorded on the active landfill site itself. It should be noted that numbers of birds on the active landfill site were low, indicating that the bird control measures in place at the active landfill site were effective at the time of the survey.

Results of 2015 Survey

A total of 17 species were recorded, with distribution, as in previous surveys, mainly along field boundaries and in forestry. Species not recorded previously at the site included Kestrel, recorded twice (assumed to be the same bird) and Mistle Thrush.

As in previous surveys two Buzzards were recorded from transects, however an additional bird was also noted between transect T2 and T3 bringing the total recorded to 3. It is assumed that up to 2 pairs of Buzzard may still be present in the area. Mallard were recorded in a drainage ditch adjacent to T3. Numbers of birds active on the constructed landfill continue to be low with only corvids such as Hooded Crow noted.

The migrant species Grasshopper Warbler, Barn Swallow, Willow Warbler and Chiffchaff were not recorded. However this is due to the timing of the survey and all are likely to occur given that suitable habitat still exists.

Results of 2016 Survey

The number of species recorded in 2016 at transects 1 – 5 was 7 (T1); 9(T2); 6(T3); 10(T4) and 9(T5). Species diversity was highest in Transect 4 (10 species) and lowest in Transect 3 (6 species). Additional species compared with previous years included Blackcap, Black-headed Gull, Coal Tit, Spotted Flycatcher, Herring Gull, Hooded Crow, Lesser Black-backed Gull, Long-tailed Tit and Magpie. At Transect 4, there was a lot of disturbance in the environs due to new and ongoing expansion works and cattle were also grazing in the adjacent field. There were no observations of Common Buzzard or Kestrel during the summer surveys in 2016.

Overall, species diversity in T1 was reduced from 15 in 2010, to 3 in 2015 and 7 in 2016. Species diversity increased in T2 from 7 in 2010 to 8 in 2015 and 9 in 2016. Species diversity in T3 was reduced in 2016 (6) compared with 2010 and 2015 (12 each year). At T4, species diversity was reduced from 15 in 2010 to 5 in 2015 and rose to 10 in 2016. At T5, species diversity was also highest in 2010 and reduced to 7 in 2015 and 9 in 2016.

Wintering Survey

A winter survey was conducted in December 2015 and January 2016 along each of the five transects. The results are presented in Table 10-11. Additional species recorded during the winter 2015/2016 surveys include Common Gull, Stonechat, Fieldfare, Redwing, Starling and Yellowhammer. Buzzards were also observed during the winter 2016 survey.

Review of Species Recorded

Overall the general assemblage of birds present is evaluated as not differing significantly from that recorded in previous surveys. Habitats on site have not significantly changed in terms of species likely to occur, with the increased area of immature woodland likely to hold the same species as previously recorded.

Due to the change in the Birds of Conservation Concern in Ireland (BoCCI) list since 2010, the status of a number of species recorded on site has changed since the previous appraisal. This includes Robin, Goldcrest and Mistle Thrush, which are now amber listed on the basis of short term declines in abundance of at least 25% (Colhoun & Cummins 2013); Meadow Pipit has moved from green to red due to declines in breeding populations (a greater than 50% decline in the short term). Conversely, the Grasshopper Warbler has moved from amber to green on the basis of a short-term increase in breeding population and an increase in the range of the species. It has been suggested that the short-term declines in species such as Meadow Pipit and other resident passerines, which formed the basis for their revised status in 2013, coincided with the prolonged cold weather experienced during the winters of 2009/10 and 2010/11 (Crowe *et al.* 2011 cited in Colhoun & Cummins 2013). These species are still widespread with very little change in range or distribution.

Barn Owl (*Tyto alba*) was recorded on the site during previous surveys (Greenstar EIS, 2008), however no nocturnal surveys were carried out as part of the work carried out in 2010, 2015 or 2016. It is likely that this species forages on the site. Golden Plover (*Pluvialis apricaria*) was recorded in arable adjacent to the site in previous surveys (Greenstar EIS, 2008), however the habitats on the landfill site provide limited suitability for this species.

3.3 Breeding Waders Survey 2019

No breeding waders were detected during the breeding wader surveys. While there is some suitable wader breeding habitat present in the form of wet grassland, at the southeast of the existing facility, no breeding waders were detected at this location. In addition, this area is too close to the Methane Plant, where disturbance is a limiting factor in relation to habitat suitability.

As the facility is an active landfill for the most part, disturbance to potential breeding waders reduces the suitability of the habitats for these species. Vehicles are continuously active within all areas of the existing facility. The general buffer applied to waders (particularly Curlew) for construction projects is 500 m (Percival, 2003).

The grassed-over landfill (amenity grassland / dry meadows and grassy verges / refuse and other waste; GA2/GS2/ED5) at the centre of the existing facility was deemed too overgrown, rank and too dry to support breeding waders such as Curlew and Lapwing. In addition, there are a lot of methane stand pipes at this location and there is evidence that corvids roost at this location, as all the stand pipes were whitewashed with bird droppings at the times of the surveys, so disturbance and predation from Hooded Crows to breeding waders is a major issue, coupled with the fact that the area is driven regularly by existing facility personnel.

The improved agricultural grasslands at the north and northeast of the existing facility were deemed unsuitable, as the fields are too small and enclosed by tall hedgerows and treelines. The fields at the northeast of the existing facility are deemed too close to human habitation, so disturbance is an issue. Also, the agricultural grasslands at the north of the existing facility were unmanaged at the times of the survey and the grass sward was too high for breeding Curlew and Lapwing. They are also very close to access roads that lead to ongoing landfill operations.

No breeding snipe were detected in the area of the southern surface water attenuation pond or the wet grassland at the southeast of the existing facility (although a single bird was flushed from wet grassland near transect 2 during winter transect surveys in January 2019). The area of the surface water attenuation pond is contained by a fence line, with little grassland vegetation. There is very little habitat within the existing facility, in the form of undisturbed wet grassland, to support breeding snipe.

With regard to breeding waders such as Curlew and Lapwing, both of these species are highly territorial and extremely vocal during the breeding season and are easily agitated, particularly by the presence of corvids, such as Hooded Crows which will prey upon eggs and young, and by human presence. Thus, both species are easily detected, if present.

In summary, the existing facility is not suitable for breeding waders due to the various landfill activities taking place, including continuous alteration and disturbance of the facility, lack of suitable breeding habitat and potential predation by corvids.

3.4 Breeding Raptors Survey 2019

While there was evidence that Buzzard is present during the breeding season and possibly breed within the general area surrounding the facility, none were detected breeding within the confines of the facility. The mature trees at the north of the existing facility offered suitable breeding habitat for raptors such as Buzzard and Sparrowhawk but none were observed breeding within this area, during the breeding surveys. There was only one observation of Sparrowhawk during the breeding season and this occurred at the surface water attenuation pond at the south of the facility, during a survey on 7th August. The bird was flushed from the dirt track at the west of the pond.

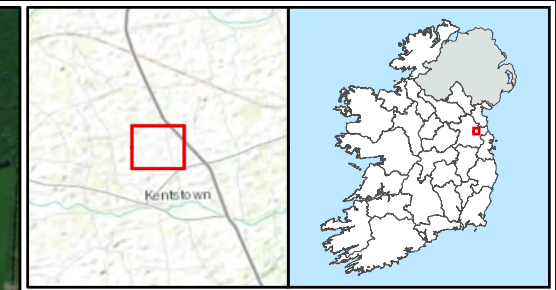
There were no sightings of Kestrel during any of the bird surveys. It is thought that the paucity of rodents, due to vermin control measures carried out at the facility, may explain their absence. Suitable habitat such as the grassed-over landfill, at the centre of the facility was deemed a likely area for their occurrence, but none were observed. It must be pointed out that Kestrels are not scavengers. They eat live prey. With regard to nesting Kestrels, they do not build nests, but will scrape a depression in the nest substrate, for example in hole nests or in the collapsed nest cup of an old crow nest (Hardey *et al.* 2006). No old Hooded Crow nests or hollow trees were observed within the existing facility during the surveys.

Buzzards were observed infrequently during all bird surveys. An old nest observed on one of the electricity pylons at the northwest of the existing facility was thought to be that of a Buzzard but was not active during surveys. During raptor vantage point surveys, particular attention was given to the overhead pylons located at the west and north of the existing facility, due to their potential for collision by birds of prey. No collisions were noted during surveys and, indeed, no birds of prey were observed perching on the pylons. These pylons and their route are likely to have been in place long before the existing facility became a landfill facility.

During vantage point watches, the permanent presence of corvids and a sizeable gull flock near the activities of the vehicles delivering refuse, were good indicators of the presence of a Buzzard within the confines of the facility. If one was present and flew within their range the flocks would take-off and the corvids would mob the raptor.

In addition to live prey, Buzzards will scavenge carrion. Observations at this landfill site during surveys showed that when refuse is delivered and deposited, it is covered up almost immediately by excavated, inert soil from elsewhere on the existing facility. Also, it was observed that pine mulch was often mixed in with the other substrates, which would aid in decomposition and reduce odour. These activities would aid in reducing the population of rodents within the area of refuse deposition and thus, reduce the presence of birds of prey within the existing facility.

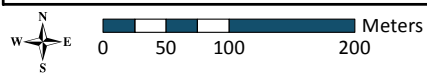
Flightlines recorded during surveys are shown in Figure 3.



- Planning Boundary
- Vantage Point
- Flightlines**
- 1. 21/06/2019. Buzzard
- 2. 07/08/2019. Sparrowhawk

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| | | | |
|--------------------|---------------------------------|-------------------|----|
| TITLE: | Flightlines 2018/19 | | |
| PROJECT: | Knockharley Landfill, Co. Meath | | |
| FIGURE NO.: | 3 | | |
| CLIENT: | Knockharley Landfill Ltd. | | |
| SCALE: | 1:6000 | REVISION: | 0 |
| DATE: | 24/10/2019 | PAGE SIZE: | A3 |



3.5 Kingfisher Survey 2019

The Kingfisher Survey concentrated on hydrological features present within the existing facility, such as streams and water bodies. The following locations within the existing facility were surveyed for the presence of Kingfishers:

- A = Water quality slightly silty, stagnant. Steeply sloped, vegetated banks. Lots of overhanging branches. No fish observed. No Kingfisher sightings.
- B and D = Similar to A. No presence of Kingfishers.
- C = Similar to above but some flow. No Kingfishers present.
- P1 = Northern surface water attenuation pond. Little or no standing water. Not suitable for Kingfisher.
- P2 = Southern surface water attenuation pond and overflow pond. Standing water and good foraging Kingfisher habitat.

On 7th August 2019 at the surface water attenuation pond, a Kingfisher was initially heard, but not immediately observed. The call of Kingfisher was played back using a tape lure. There was no response at first. After the second playback, a Kingfisher appeared, and landed on a pipe jutting out into the pond. It remained on the pipe briefly and took off in a south easterly direction over deciduous forestry. A pond net sample at this location undertaken as part of the aquatic surveys in 2019 confirmed that Three-spined Stickleback *Gasterosteus aculeatus* occur within the pond. The presence of a Grey Heron observed at the pond on most survey dates also confirms that low numbers of fish were present.

Examination of the culvert into the pond did not detect evidence of breeding activity during the summer. Due to the late date of the sighting and the fact that no Kingfishers were observed during previous surveys at this location during the summer, it is thought that this sighting concerned a transient bird passing through, but not breeding at the existing facility.

Full results from the Kingfisher vantage point surveys are shown in the companion aquatic ecology report (Triturus, 2019). Briefly, no Kingfishers were recorded during surveys; however, a single bird was recorded during walkover surveys flying upstream along the Flemingstown stream near the landfill boundary on 22/08/2019. Overall, habitat was typically considered sub-optimal for Kingfishers with no nesting sites recorded and limited suitable perch sites available.

3.6 Transect Surveys 2018/19

3.6.1 Winter Birds

The results of the winter bird surveys are provided in Table 4 over:

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Table 3-2: Bird species recorded from all transects within the study area during winter birds transect surveys²

| Common name | Scientific name | Transect 1 | | | | Transect 2 | | | | Transect 3 | | | | Transect 4 | | | | Transect 5 | | | | Total 0-25 m and 25-100 m |
|--------------------------|-----------------------------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------------|
| | | 11/12/2018 | | 12/12/2018 | | 11/12/2018 | | 12/12/2018 | | 11/12/2018 | | 12/12/2018 | | 11/12/2018 | | 12/12/2018 | | 11/12/2018 | | 12/12/2018 | | |
| | | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | |
| Black-headed gull | <i>Chroicocephalus ridibundus</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| Blackbird | <i>Turdus merula</i> | 4 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 3 | 0 | 6 | 0 | 0 | 0 | 1 | 0 | 4 | 1 | 2 | 0 | 22 |
| Blue tit | <i>Parus caeruleus</i> | 4 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 2 | 0 | 1 | 0 | 3 | 0 | 2 | 0 | 23 |
| Bullfinch | <i>Pyrrhula pyrrhula</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| Buzzard | <i>Buteo buteo</i> | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 2 |
| Chaffinch | <i>Fringilla coelebs</i> | 0 | 0 | 3 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 6 | 10 |
| Coal tit | <i>Periparus ater</i> | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Common Gull | <i>Larus canus</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dunnock | <i>Prunella modularis</i> | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 5 |
| Fieldfare | <i>Turdus pilaris</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Goldfinch | <i>Carduelis carduelis</i> | 0 | 0 | 6 | 0 | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 0 | 0 | 17 | 0 | 0 | 0 | 0 | 0 | 53 |
| Great black-backed gull | <i>Larus marinus</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Great tit | <i>Parus major</i> | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 5 |
| Herring gull | <i>Larus argentatus</i> | 0 | 0 | 4 | 4 | 0 | 2 | 0 | 1 | 0 | 74 | 0 | 5 | 100 | 22 | 0 | 0 | 0 | 1 | 0 | 1 | 104 |
| Hooded crow | <i>Corvus corone</i> | 1 | 7 | 2 | 9 | 0 | 5 | 3 | 3 | 0 | 60 | 15 | 27 | 1 | 57 | 15 | 18 | 0 | 9 | 0 | 19 | 37 |
| Jackdaw | <i>Corvus monedula</i> | 0 | 0 | 0 | 2 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 6 | 0 | 0 | 0 | 0 | 0 |
| Jay | <i>Garrulus glandarius</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Lesser black-backed gull | <i>Larus fuscus</i> | 0 | 3 | 1 | 1 | 0 | 7 | 0 | 0 | 0 | 19 | 0 | 0 | 20 | 19 | 0 | 0 | 0 | 0 | 0 | 1 | 21 |

² Colours correspond to BoCCI conservation status. Annex I species highlighted in bold.

| Common name | Scientific name | Transect 1 | | | | Transect 2 | | | | Transect 3 | | | | Transect 4 | | | | Transect 5 | | | | Total 0-25 m and 25-100 m |
|------------------|--------------------------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------------|
| | | 11/12/2018 | | 12/12/2018 | | 11/12/2018 | | 12/12/2018 | | 11/12/2018 | | 12/12/2018 | | 11/12/2018 | | 12/12/2018 | | 11/12/2018 | | 12/12/2018 | | |
| | | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | |
| Linnet | <i>Carduelis cannabina</i> | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| Long-tailed tit | <i>Aegithalos caudatus</i> | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 8 |
| Magpie | <i>Pica pica</i> | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 |
| Meadow pipit | <i>Anthus pratensis</i> | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| Mistle thrush | <i>Turdus viscivorus</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 3 |
| Peregrine falcon | <i>Falco peregrinus</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| Pheasant | <i>Phasianus colchicus</i> | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 5 |
| Pied wagtail | <i>Motacilla alba yarelli</i> | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 4 |
| Redwing | <i>Turdus iliacus</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 27 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reed bunting | <i>Emberiza schoeniclus</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| Robin | <i>Erithacus rubicola</i> | 1 | 0 | 4 | 0 | 2 | 0 | 0 | 0 | 3 | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 15 |
| Rook | <i>Corvus frugilegus</i> | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 7 | 0 | 0 | 15 | 40 | 0 | 1 | 0 | 18 | 0 | 1 | 2 | 31 | 17 |
| Snipe | <i>Gallinago gallinago</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Song thrush | <i>Turdus philomelos</i> | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 3 | 2 | 8 |
| Sparrowhawk | <i>Accipiter nisus</i> | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Starling | <i>Sturnus vulgaris</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Woodpigeon | <i>Columba palumbus</i> | 0 | 8 | 0 | 0 | 0 | 6 | 22 | 1 | 0 | 8 | 0 | 6 | 4 | 5 | 15 | 3 | 1 | 1 | 5 | 1 | 47 |
| Wren | <i>Troglodytes troglodytes</i> | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 8 |

A total of 36 species were observed at the existing facility during the winter transect surveys. Bird species observed in winter are typical of the habitats present at the existing facility.

There was only one observation of Buzzard during the winter transect surveys. This occurred at the northeast of the existing facility, when a bird was flushed from a tree and flew east, off the existing facility.

There was one observation of Peregrine Falcon during the winter transect surveys. This observation concerned a bird flying north over the grassed-over landfill, from TR-2 and was thought to be merely passing through the facility. This species is more frequent at coastal sites in winter.

There were no observations of Kestrel during the winter transect surveys. This may be due to the paucity of prey items such as rodents.

There was a continuous presence of gulls and corvids within the area of active landfill operations, which is to be expected and would deter birds of prey.

Meadow Pipit was scarce at the facility in winter. In addition, there were no records of Skylark during the winter transect survey. These two species tend to leave inland breeding sites during the winter months and are more frequent at coastal sites in winter. They tend to return to breeding sites from early February onwards. Meadow Pipit is a Red-Listed Species in Ireland, a species whose populations have declined by at least 50% over 25 years, in addition to other criteria, such as a decline in breeding range and non-breeding population decline (Colhoun and Cummins 2013).

There were no records of Golden Plover *Pluvialis apricaria* during the winter bird transect survey, or indeed, any other surveys carried out within the existing facility. There is no suitable habitat present within the existing facility for feeding or roosting Golden Plover. While some suitable habitat exists in the farmlands surrounding the facility, no Golden Plovers were observed or heard during winter survey work carried out at the facility.

There were no observations of Whooper Swan *Cygnus cygnus* during the winter bird transect surveys, or any other surveys carried out in winter. There is no suitable habitat present at the facility for wintering Whooper Swan in the form of flooded fields/callows for roosting/feeding or grassland for feeding. There is no suitable habitat in the surrounding hinterland either. The arable fields surrounding the facility are deemed too small and enclosed by tall treelines and hedgerows. These two species like to have a broad, uninterrupted view of the surrounding hinterland, while feeding or roosting.

While it must be pointed out that dedicated Whooper Swan and Golden Plover vantage point surveys to record overflying birds at dusk or night were not carried out during this survey period, winter survey work to determine the presence/absence of these two species is ongoing at the facility, and surveys will be carried out in the winter of 2019 and 2020.

Table 5 shows the SPA sites within 100 km of the existing facility that list Golden Plover and/or Whooper Swan as special conservation interests. There are 10 SPA sites within 100 km, with the Boyne Estuary SPA (code 004080) closest at 14.7 km north east of the existing facility. Golden Plover are listed as special interests at seven of the SPA sites and Whooper Swan at five.

I-WeBS counts by birdwatch Ireland from 2006/07 to 2015/16 show a mean number of 606 Golden Plover recorded at this site with a peak number of 1,800 recorded during the winter of 2012/13. The mean count during the same period for the River Nanny SPA located c. 17 km from the site was 145 Golden Plover with a peak number of 450 in the winter of 2009/10.

Table 3-3: SPAs within 100 km of Knockharley existing facility with Golden Plover and/or Whooper Swan as special conservation interests

| Species | SPA (site code) | Distance from existing facility |
|---------------|--|---------------------------------|
| Golden Plover | Boyne Estuary SPA (004080) | Ca. 14.7 km northeast |
| Golden Plover | River Nanny Estuary and Shore SPA (004158) | Ca. 17.4 km east |
| Golden Plover | Dundalk Bay SPA (004026) | Ca. 29 km northeast |
| Golden Plover | Malahide Estuary SPA (004025) | Ca. 29 km southeast |
| Golden Plover | Baldoyle Bay SPA (004016) | Ca. 36 km southeast |
| Golden Plover | North Bull Island SPA (004006) | Ca. 38.3 km southeast |
| Whooper Swan | Lough Iron SPA (004046) | Ca. 61 km west |
| Whooper Swan | Glen Lough SPA (004045) | Ca 61 km west |
| Whooper Swan | Lough Oughter Complex SPA (004049) | Ca. 70 km northwest |
| Golden Plover | Lough Ree SPA (004064) | Ca. 87 km west |
| Whooper Swan | Lough Ree SPA (004064) | Ca. 87 km west |
| Golden Plover | Middle Shannon Callows SPA (004096) | Ca. 97 km southwest |
| Whooper Swan | Middle Shannon Callows SPA (004096) | Ca. 97 km southwest |

Table 6 shows the winter distribution and numbers of wintering Golden Plover and Whooper Swan, obtained from annual Irish Wetland Bird Surveys (IWeBS) carried out at dedicated survey sites, within 50 km of Knockharley Landfill.

Within 50 km of the Knockharley facility there are two I-WeBS sites:

- Killiner Quarry, Drogheda (site code: 02201) – 13 km northeast of existing facility;
- River Boyne, Rossnaree (site code: 0V301) – ca. 6 km northeast of existing facility.

Records of Golden Plover and/or Whooper Swan were only recorded at River Boyne, Rossnaree (site code: 0V301). See Table 6 below for records.

Table 3-4: Records of Golden Plover and Whooper Swan from River Boyne, Rossnaree (code 0V301) I-WeBS site

| SPA_Name | National | International | 2006/07 | 2007/08 | 2008/09 | 2009/10 | 2010/11 | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | Mean |
|---------------|----------|---------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| Golden Plover | 1200 | 9300 | 31 | 300 | 50 | 90 | 553 | 600 | 1800 | 300 | 300 | 30 | 606 |
| Whooper Swan | 150 | 270 | 11 | 46 | 247 | 152 | 82 | 9 | 10 | 27 | 32 | 27 | 21 |

3.6.2 Breeding Birds

The results of the breeding bird transects is shown in Table 7 below.

Table 3-5: Bird species recorded from all transects within the study area, during summer birds transect surveys.³

| Common name | Scientific name | Transect 1 | | | | Transect 2 | | | | Transect 3 | | | | Transect 4 | | | | Transect 5 | | | | Total 0-25 m and 25-100 m | Breeding status ⁴ |
|--------------|-------------------------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------------|------------------------------|
| | | Visit 1 | | Visit 2 | | Visit 1 | | Visit 2 | | Visit 1 | | Visit 2 | | Visit 1 | | Visit 2 | | Visit 1 | | Visit 2 | | | |
| | | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | | |
| Blackbird | <i>Turdus merula</i> | 3 | 3 | 1 | 0 | 0 | 4 | 1 | 0 | 5 | 0 | 1 | 0 | 3 | 1 | 0 | 0 | 3 | 0 | 0 | 0 | 17 | Pr |
| Blackcap | <i>Sylvia atricapilla</i> | 0 | 0 | 0 | 0 | 4 | 0 | 5 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | Pr |
| Blue tit | <i>Parus caeruleus</i> | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | Pr |
| Bullfinch | <i>Pyrrhula pyrrhula</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | Pr |
| Buzzard | <i>Buteo buteo</i> | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | NB |
| Chaffinch | <i>Fringilla coelebs</i> | 2 | 0 | 1 | 0 | 6 | 0 | 2 | 0 | 3 | 1 | 0 | 0 | 4 | 2 | 2 | 0 | 4 | 0 | 0 | 0 | 24 | Pr |
| Chiffchaff | <i>Phylloscopus collybita</i> | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | Po |
| Coal tit | <i>Parus ater</i> | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 4 | Pr |
| Cuckoo | <i>Cuculus conarus</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | F |
| Dunnock | <i>Prunella modularis</i> | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | Pr |
| Goldcrest | <i>Regulus regulus</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 3 | Pr |
| Goldfinch | <i>Carduelis carduelis</i> | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | Pr |
| Great tit | <i>Parus major</i> | 1 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 1 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 9 | Pr |
| Greenfinch | <i>Carduelis chloris</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Pr |
| Heron | <i>Ardea cinerea</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | F |
| Herring gull | <i>Larus argentatus</i> | 0 | 4 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | F |
| Hooded crow | <i>Corvus corone</i> | 0 | 5 | 3 | 0 | 0 | 7 | 1 | 0 | 18 | 18 | 15 | 0 | 1 | 17 | 2 | 0 | 0 | 0 | 2 | 0 | 42 | Po |
| House martin | <i>Delichon urbica</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NB |

³ Colour corresponds to BoCCI conservation status. Annex I species highlighted in Bold.⁴ Pr = probable breeding, NB = non-breeding, Po = possible breeder, F = flyover and C = confirmed breeding

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| Common name | Scientific name | Transect 1 | | | | Transect 2 | | | | Transect 3 | | | | Transect 4 | | | | Transect 5 | | | | Total 0-25 m and 25-100 m | Breeding status ⁴ |
|--------------------------|-----------------------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------------|------------------------------|
| | | Visit 1 | | Visit 2 | | Visit 1 | | Visit 2 | | Visit 1 | | Visit 2 | | Visit 1 | | Visit 2 | | Visit 1 | | Visit 2 | | | |
| | | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | | |
| House sparrow | <i>Passer domesticus</i> | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | C |
| Jackdaw | <i>Crovis monedula</i> | 0 | 1 | 0 | 0 | 1 | 5 | 0 | 0 | 4 | 1 | 8 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | C |
| Jay | <i>Garrulus glandarius</i> | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | Po |
| Lesser black-backed gull | <i>Larus fuscus</i> | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 6 | 0 | 64 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | F |
| Lesser redpoll | <i>Carduelis cabaret</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Po |
| Linnet | <i>Carduelis cannabina</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | Po |
| Magpie | <i>Pica pica</i> | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | Po |
| Meadow pipit | <i>Anthus pratensis</i> | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | Po |
| Mute swan | <i>Cygnus olor</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | C |
| Pheasant | <i>Phasianus colchicus</i> | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 3 | 0 | 7 | Po |
| Pied wagtail | <i>Motacilla alba</i> | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 3 | 4 | 0 | 0 | 1 | 0 | 0 | 6 | C |
| Raven | <i>Corvus corax</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Pr |
| Reed bunting | <i>Emberiza schoeniclus</i> | 2 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | C |
| Robin | <i>Erithacus rubicola</i> | 1 | 2 | 2 | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 12 | C |
| Rook | <i>Corvus frugilegus</i> | 0 | 7 | 0 | 7 | 0 | 31 | 0 | 5 | 26 | 9 | 0 | 20 | 0 | 10 | 0 | 10 | 0 | 7 | 0 | 5 | 26 | NB |
| Skylark | <i>Alauda arvensis</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Pr |
| Song thrush | <i>Turdus philomelos</i> | 1 | 1 | 0 | 0 | 3 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 10 | Pr |
| Starling | <i>Sturnus vulgaris</i> | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 1 | NB |

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| Common name | Scientific name | Transect 1 | | | | Transect 2 | | | | Transect 3 | | | | Transect 4 | | | | Transect 5 | | | | Total 0-25 m and 25-100 m | Breeding status ⁴ | |
|----------------|--------------------------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------|------------|---------------------------|------------------------------|----|
| | | Visit 1 | | Visit 2 | | Visit 1 | | Visit 2 | | Visit 1 | | Visit 2 | | Visit 1 | | Visit 2 | | Visit 1 | | Visit 2 | | | | |
| | | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | 0-25 m and 25-100 m | >100m / FO | | | |
| Stonechat | <i>Saxicola torquata</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Pr |
| Swallow | <i>Hirundo rustica</i> | 0 | 4 | 0 | 20 | 0 | 11 | 0 | 11 | 0 | 4 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | NB |
| Tree sparrow | <i>Passer montanus</i> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Pr |
| Willow warbler | <i>Phylloscopus trochilus</i> | 2 | 0 | 0 | 0 | 2 | 2 | 3 | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | Pr |
| Wood pigeon | <i>Columba palumbus</i> | 1 | 18 | 2 | 0 | 5 | 12 | 3 | 0 | 1 | 2 | 3 | 0 | 2 | 42 | 5 | 0 | 7 | 25 | 3 | 0 | 32 | Pr | |
| Wren | <i>Troglodytes troglodytes</i> | 2 | 0 | 0 | 0 | 2 | 0 | 5 | 0 | 1 | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | Pr |

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Additional species recorded during the breeding raptor survey can be seen in Table 8 below.

Table 3-6: Additional bird species recorded within the study area during summer breeding raptor surveys⁵

| Common Name | Scientific Name | 08/07/2019 | 07/08/2019 | Notes | Breeding status ⁶ |
|-------------------------|-------------------------------|------------|------------|---|------------------------------|
| Barn Swallow | <i>Hirundo rustica</i> | 37 | 25 | Breed in sheds at the entrance and one pair in the falcon shed. Very common at the facility in summer | C |
| Blackbird | <i>Turdus merula</i> | 4 | 1 | Common at the facility | Pr |
| Blackcap | <i>Sylvia atricapilla</i> | 4 | - | Frequent summer breeder | Pr |
| Blue Tit | <i>Parus caeruleus</i> | - | 3 | Scarce on facility | Pr |
| Bullfinch | <i>Pyrrhula pyrrhula</i> | 2 | 1 | Scarce on facility | Pr |
| Chaffinch | <i>Fringilla coelebs</i> | 6 | 6 | Frequent at the facility | Pr |
| Chiffchaff | <i>Phylloscopus collybita</i> | 1 | - | Scarce on facility | Po |
| Coal Tit | <i>Parus ater</i> | 1 | 1 | Scarce on facility | Po |
| Dunnock | <i>Prunella modularis</i> | 1 | 1 | Occasional at the facility | Pr |
| Goldcrest | <i>Regulus Regulus</i> | 1 | 2 | Scarce on facility | Pr |
| Goldfinch | <i>Carduelis carduelis</i> | 2 | 19 | Flock of 15 along TR-3 on 7/8 | Pr |
| Great Tit | <i>Parus major</i> | 5 | 5 | Frequent at the facility | Pr |
| Great Black-backed Gull | <i>Larus marinus</i> | 3 | - | A scarce bird at the active landfill | NB |
| Greenfinch | <i>Carduelis chloris</i> | 1 | 1 | A scarce bird on facility | Pr |
| Grey Heron | <i>Ardea cinerea</i> | 1 | 1 | Southern surface water attenuation pond at TR-3 | F |

⁵ Colour corresponds to BoCCI conservation status. Annex I species highlighted in Bold.

⁶ Pr = probable breeding, NB = non-breeding, Po = possible breeder, F = flyover and C = confirmed breeding

| Common Name | Scientific Name | 08/07/2019 | 07/08/2019 | Notes | Breeding status ⁶ |
|--------------------------|----------------------------|------------|------------|--|------------------------------|
| Grey Wagtail | <i>Motacilla cinerea</i> | 1 | - | Immature bird at the southern surface water attenuation pond on TR-2 | C |
| Herring Gull | <i>Larus argentatus</i> | 72 | 4 | All observed with Lesser Black-backed Gulls | F |
| Hooded Crow | <i>Corvus corone</i> | 8 | 12 | Common over the facility | Po |
| House Martin | <i>Delichon urbica</i> | 19 | 2 | 19 feeding over southern surface water attenuation pond. | NB |
| Jackdaw | <i>Corvus monedula</i> | 25 | - | Common at the facility | C |
| Kingfisher | <i>Alcedo atthis</i> | - | 1 | Flushed at the southern surface water attenuation pond. No evidence of breeding | NB |
| Lesser Black-backed Gull | <i>Larus Fuscus</i> | 240 | 108 | Large build up in July on excavated soil, east of TR-3 | F |
| Linnet | <i>Carduelis cannabina</i> | 14 | 5 | South of grassed over landfill along TR-3 | Po |
| Meadow Pipit | <i>Anthus pratensis</i> | 8 | - | Frequent in summer. Mainly over the grassed over land fill and grasslands at the north of the facility | Po |
| Moorhen | <i>Gallinula chloropus</i> | 1 | - | Southern surface water attenuation pond at TR-2 | Po |

| Common Name | Scientific Name | 08/07/2019 | 07/08/2019 | Notes | Breeding status ⁶ |
|----------------|--------------------------------|------------|------------|---|------------------------------|
| Mute Swan | <i>Cygnus olor</i> | 5 | 5 | Two adults and five cygnets at southern surface water attenuation pond along TR-3. Three cygnets in the July and August count | C |
| Pheasant | <i>Phasianus colchicus</i> | 1 | 1 | Frequently heard at the facility | Po |
| Pied Wagtail | <i>Motacilla alba yarelli</i> | 5 | 4 | Common at the facility | C |
| Reed Bunting | <i>Emberiza schoeniclus</i> | 5 | - | Common at the at the southern surface water attenuation pond | C |
| Robin | <i>Erithacus rubicola</i> | 6 | 3 | Common on-facility | C |
| Rook | <i>Corvus frugilegus</i> | 29 | - | Very common at the facility | NB |
| Sedge Warbler | <i>Emberiza schoeniclus</i> | | 1 | An immature west of falcon shed along TR-2. Did not breed at the facility | Po |
| Song Thrush | <i>Turdus philomelos</i> | 1 | - | | Pr |
| Sparrowhawk | <i>Accipiter nisus</i> | - | 1 | Flushed from hedgerow at southern surface water attenuation pond | Po |
| Stock Dove | <i>Columba oenas</i> | 4 | 1 | Grassed-over landfill | Po |
| Tree Sparrow | <i>Passer montanus</i> | 2 | - | Flushed from grassed-over landfill | Pr |
| Willow Warbler | <i>Phylloscopus trochilus</i> | 6 | 6 | Common summer visitor | C |
| Woodpigeon | <i>Columba palumbus</i> | 11 | 5 | Common at the facility | Pr |
| Wren | <i>Troglodytes troglodytes</i> | 2 | 2 | Common at the facility | Pr |

A total of 42 species were recorded during the summer breeding bird transect surveys, and species observed are typical of the habitats present at the facility. An additional eight species were also recorded during breeding raptor surveys.

There was a greater number of species recorded during the summer transect surveys than the winter, due to the number of migrant birds returning to the facility to breed. Typical migrant species include Blackcap, Chiffchaff, Willow Warbler, Swallow and House Martin.

Meadow Pipit numbers increased at the facility during the summer period, due to returning birds from coastal or lowland areas. Skylark remained very scarce, with only one record from the grassed-over landfill outside the footprint of the proposed development. Skylark is an Amber-listed species in Ireland, a species that has undergone a moderate decline in abundance of between 25% and 49% over the past 13 years. (Colhoun and Cummins 2013).

There was only one observation of Cuckoo in the early summer, a Green-Listed species.

There were a number of notable bird observations from the area of the grassed-over landfill. While this part of the existing facility was not included in the transect surveys it could be viewed looking north and west from TR-2 and east, from TR-3. In addition, the raptor vantage point survey was carried out from the top of this landfill and was frequently visited.

Three species were recorded from this area of the existing facility and nowhere else, and the birds recorded appeared to remain faithful to this part of the existing facility. These included Stock Dove, Tree Sparrow and Stonechat. Stock Dove has undergone a significant range contraction in Ireland over the past forty years (Balmer *et al.* 2013). Tree Sparrow numbers appear to be stable, and the Irish population is mainly concentrated in the east and southeast of the island (Balmer *et al.* 2013). However, it still remains a scarce bird throughout much of its range. Stonechat numbers suffered a serious population crash during the harsh winters of 2009/10 and 2010/11 but their numbers have increased in subsequent years (Balmer *et al.* 2013). The grassed-over landfill area outside the footprint of the proposed development remains an important bird habitat for these three species, which are Amber-Listed.

The surface water attenuation pond and associated wetland at the south of the facility is also an important bird habitat. A number of species were recorded from this habitat and nowhere else within the existing facility. These included Kingfisher (discussed in 3.5), Grey Heron, Grey Wagtail, Reed Bunting, Mute Swan and Moorhen. The pond was also an important feeding area for hirundines such as Barn Swallow and House Martin. Grey Wagtail is a Red-Listed Species.

Kingfisher, Barn Swallow and House Martin are Amber-Listed species. Grey Heron and Moorhen are Green-Listed, species that are currently of favourable conservation status.

There was only one observation of Sparrowhawk at the existing facility during the summer bird survey where an individual was flushed from the area of the southern attenuation pond. While this species may breed in the surrounding woodland, there were no other sightings.

There were only three observations of Common Buzzard during the summer transect survey and no observations of Kestrel. In general, birds of prey are scarce at the existing facility in summer, which may be a reflection of lack of prey items and disturbance due to corvids and gulls.

Contrary to the initial findings of the EIAR on avifauna at the facility, there is little or no suitable habitat for breeding Yellowhammer, a Red-Listed species. There is no arable land within the existing facility a favoured habitat for foraging Yellowhammer. While the hedgerows at the north and northeast of the facility may afford some habitat, none were observed or heard at this part of the existing facility, during the summer bird surveys. The surrounding farmland may hold some birds, but none were heard or observed during the surveys.

3.7 Barn Owl Survey

There was no evidence of Barn Owl present or nesting at the facility. It was found that the majority of woodland at the facility was deemed too immature. No hollow trees or nest boxes were located during the Barn Owl surveys. The only suitable buildings that could potentially hold breeding Barn Owls were at a farm to the northeast of the facility. There was no evidence that Barn Owls were present at this location during the survey period.

There were no direct observations of Barn Owls during any of the existing facility surveys. It is thought that the lack of prey items due to vermin control may be a factor.

3.8 Summary of Bird Survey Results

Table 9 provides a summary of the bird assessment for rare/threatened and/or protected bird species only. It contains information from the EIAR and is updated to include the 2018/19 desktop and field studies. It outlines whether a bird species recorded during the desktop study was subsequently recorded within the existing facility during the bird surveys that took place from 2010 – 2019 and the potential for the species to utilise the existing facility. Note, results are combined from both winter and summer surveys.

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Table 3-7: Bird Survey Summary Results for Threatened/Rare and/or Protected Species

| Common Name (Scientific Name) | Desktop Study (NBDC & NPWS) | 2010 Survey | 2015 Survey | 2016 Survey | 2018/19 Survey | Notes | Potential for species to utilise the existing facility |
|--|-----------------------------|-------------|-------------|-------------|----------------|---|---|
| Barn Owl (<i>Tyto alba</i>) | ✓ | ✗ | ✗ | ✗ | ✗ | None observed during surveys | Only suitable buildings on farm to northeast of facility. However there was no evidence of these buildings being used by Barn Owl |
| Barn Swallow (<i>Hirundo rustica</i>) | ✓ | ✓ | ✗ | ✗ | ✓ | Recorded during surveys | Ponds provide feeding habitat. Confirmed breeding at sheds at facility entrance and in falcon shed |
| Black-headed Gull (<i>Larus ridibundus</i>) | ✓ | ✗ | ✓ | ✓ | ✓ | Recorded during surveys | Landfill provides feeding habitat |
| Buzzard (<i>Buteo buteo</i>) | ✗ | ✗ | ✗ | ✓ | ✓ | Recorded during surveys | Feeding habitat and some suitable breeding habitat to north of existing facility |
| Common Coot (<i>Fulica atra</i>) | ✓ | ✗ | ✗ | ✗ | ✗ | Recorded as additional species 2010-2016 (outside of surveys) | Southern attenuation pond and reed bed suitable feeding/breeding habitat |
| Common Kestrel (<i>Falco tinnunculus</i>) | ✓ | ✗ | ✓ | ✗ | ✗ | Recorded only once in 2015 survey | Paucity of prey species likely makes facility unsuitable feeding habitat |
| Common Kingfisher (<i>Alcedo atthis</i>) | ✓ | ✗ | ✗ | ✗ | ✓ | Recorded once in 2019 survey. | Southern attenuation pond and reed bed suitable for transient but not breeding birds |
| Common Linnet (<i>Carduelis cannabina</i>) | ✓ | ✓ | ✗ | ✓ | ✓ | Recorded in majority of transect surveys. | Small amounts of suitable habitat on existing facility margins and over-grassed area. |
| Common Pheasant (<i>Phasianus colchicus</i>) | ✓ | ✓ | ✓ | ✓ | ✓ | Recorded in all transect surveys. | Suitable feeding habitat near farm |
| Common Sandpiper (<i>Actitis hypoleucos</i>) | ✓ | ✗ | ✗ | ✗ | ✗ | Not recorded in surveys. | Attenuation ponds and reed beds could provide suitable feeding habitat. |

| Common Name (Scientific Name) | Desktop Study (NBDC & NPWS) | 2010 Survey | 2015 Survey | 2016 Survey | 2018/19 Survey | Notes | Potential for species to utilise the existing facility |
|--|-----------------------------|-------------|-------------|-------------|----------------|---|---|
| Common Snipe (<i>Gallinago gallinago</i>) | ✓ | ✗ | ✗ | ✗ | ✓ | Recorded once in transect survey in 2018/19 | Very little breeding habitat. Only one observation during the winter season. |
| Common Starling (<i>Sturnus vulgaris</i>) | ✓ | ✗ | ✓ | ✓ | ✓ | Recorded in most surveys. | Limited feeding habitat, mainly to north of facility |
| Common Swift (<i>Apus apus</i>) | ✓ | ✗ | ✗ | ✗ | ✗ | Not recorded in any surveys. | Pond habitats suitable for foraging. |
| Common Wood Pigeon (<i>Columba palumbus</i>) | ✓ | ✓ | ✓ | ✓ | ✓ | Recorded in all surveys. | Suitable habitats surrounding facility |
| Cormorant (<i>Phalacrocorax carbo</i>) | ✓ | ✗ | ✗ | ✗ | ✗ | Not recorded in any surveys. | Habitats largely unsuitable for foraging. |
| Eurasian Tree Sparrow (<i>Passer montanus</i>) | ✓ | ✗ | ✗ | ✗ | ✓ | Recorded in one transect survey in 2019. | Grassed-over landfill area (outside footprint) provides important habitat |
| Eurasian Woodcock (<i>Scolopax rusticola</i>) | ✓ | ✗ | ✗ | ✗ | ✗ | Not recorded in any surveys. | Limited wader habitat available. |
| Goldcrest (<i>Regulus regulus</i>) | ✗ | ✓ | ✓ | ✓ | ✓ | Recorded in all surveys. | Suitable feeding / breeding habitat on facility margins |
| Golden Plover (<i>Pluvialis apricaria</i>) | ✓ | ✗ | ✗ | ✗ | ✗ | Not recorded in any surveys. | Limited feeding/roosting habitat available within facility. Some suitable habitat exists in the farmlands surrounding the existing facility, but no golden plovers were observed or heard during winter survey work carried out at the existing facility. |
| Greenfinch (<i>Carduelis chloris</i>) | ✗ | ✗ | ✗ | ✗ | ✓ | Recorded in 2018/19 surveys only. | Some limited feeding habitat near facility entrance |

| Common Name (Scientific Name) | Desktop Study (NBDC & NPWS) | 2010 Survey | 2015 Survey | 2016 Survey | 2018/19 Survey | Notes | Potential for species to utilise the existing facility |
|--|-----------------------------|-------------|-------------|-------------|----------------|---------------------------------------|--|
| Great Black-backed Gull (<i>Larus</i>) | x | x | x | x | ✓ | Recorded in 2018/19 surveys only. | Feeding habitat on landfill |
| Grey Heron (<i>Ardea cinerea</i>) | ✓ | x | x | ✓ | ✓ | Recorded in 2016 and 2018/19 surveys. | Ponds provide feeding habitat. |
| Grey Wagtail (<i>Motacilla cinerea</i>) | x | x | x | x | ✓ | Recorded in 2018/19 surveys only. | Ponds provide feeding habitat. Confirmed breeding so suitable breeding habitat present near ponds. |
| Herring Gull (<i>Larus argentatus</i>) | ✓ | ✓ | ✓ | ✓ | ✓ | Recorded in all surveys. | Feeding habitat on landfill |
| House Martin (<i>Delichon urbicum</i>) | ✓ | x | x | x | ✓ | Recorded once in 2019 surveys. | Ponds provide feeding habitat. |
| House Sparrow (<i>Passer domesticus</i>) | ✓ | x | x | x | ✓ | Recorded once in 2019 surveys. | Some suitable habitat on facility margins. Confirmed breeding. |
| Lesser black-backed gull (<i>Larus fuscus</i>) | x | ✓ | ✓ | ✓ | ✓ | Recorded in all surveys. | Feeding habitat on landfill |
| Mallard (<i>Anas platyrhynchos</i>) | ✓ | ✓ | x | x | x | Recorded once in 2010. | Attenuation pond / reed bed suitable habitat for feeding and breeding. |
| Meadow Pipit (<i>Anthus pratensis</i>) | x | ✓ | ✓ | ✓ | ✓ | Recorded in all surveys. | Some habitat on grassed-over areas suitable. |
| Mew Gull (<i>Larus canus</i>) | ✓ | ✓ | x | x | ✓ | Recorded in 2010 and 2018/19 surveys. | Feeding habitat on landfill |
| Mistle Thrush (<i>Turdus viscivorus</i>) | x | x | x | ✓ | ✓ | Recorded in 2016 and 2018/19 surveys. | Suitable habitat within forestry. |

| Common Name (Scientific Name) | Desktop Study (NBDC & NPWS) | 2010 Survey | 2015 Survey | 2016 Survey | 2018/19 Survey | Notes | Potential for species to utilise the existing facility |
|---|-----------------------------|-------------|-------------|-------------|----------------|--|---|
| Moorhen (<i>Gallinula chloropus</i>) | ✓ | ✗ | ✗ | ✗ | ✓ | Recorded in 2018/19 surveys only. | Ponds provide feeding habitat. |
| Mute Swan (<i>Cygnus olor</i>) | ✓ | ✗ | ✗ | ✗ | ✓ | Recorded in 2018/19 surveys only. | Ponds provide feeding/breeding habitat. Confirmed breeding. |
| Northern Lapwing (<i>Vanellus vanellus</i>) | ✓ | ✗ | ✗ | ✗ | ✗ | Not recorded in any surveys. | Limited suitable habitat present |
| Peregrine Falcon (<i>Falco peregrinus</i>) | ✓ | ✗ | ✗ | ✗ | ✓ | Recorded in 2018/19 surveys. | Limited feeding and breeding habitat |
| Robin (<i>Erithacus rubecula</i>) | ✗ | ✓ | ✓ | ✓ | ✓ | Recorded in all surveys. | Abundant suitable feeding/breeding habitat on facility margins. Confirmed breeding. |
| Ringed Plover (<i>Charadrius hiaticula</i>) | ✓ | ✗ | ✗ | ✗ | ✗ | Not recorded in any surveys. | Limited wader breeding habitat. |
| Rock Pigeon (<i>Columba livia</i>) | ✓ | ✗ | ✗ | ✗ | ✗ | Not recorded in any surveys. | Limited breeding habitat. |
| Sand Martin (<i>Riparia riparia</i>) | ✓ | ✗ | ✗ | ✗ | ✗ | Not recorded in any surveys (recorded as additional species outside surveys only). | No breeding habitat; feeding habitat present at ponds. |
| Sky Lark (<i>Alauda arvensis</i>) | ✓ | ✓ | ✗ | ✗ | ✓ | Recorded in 2010 and 2018/19 surveys. | Small amount breeding habitat present; some over-grassed areas suitable. |
| Sparrowhawk (<i>Accipiter nisus</i>) | ✗ | ✗ | ✗ | ✗ | ✓ | Recorded in 2018/19 surveys only. | Suitable breeding habitat to north of existing facility |

| Common Name (Scientific Name) | Desktop Study (NBDC & NPWS) | 2010 Survey | 2015 Survey | 2016 Survey | 2018/19 Survey | Notes | Potential for species to utilise the existing facility |
|---|-----------------------------|-------------|-------------|-------------|----------------|-----------------------------------|---|
| Spotted Flycatcher (<i>Muscicapa striata</i>) | ✓ | ✗ | ✗ | ✓ | ✗ | Recorded in 2016 surveys only. | Some limited feeding habitat. |
| Stock Dove (<i>Columba oenas</i>) | ✗ | ✗ | ✗ | ✗ | ✓ | Recorded in 2018/19 surveys only. | Grassed-over landfill area provides important feeding habitat |
| Stonechat (<i>Saxicola rubicola</i>) | ✗ | ✗ | ✗ | ✓ | ✓ | Recorded in 2016 and 2018/19. | Grassed-over landfill area provides important feeding habitat; potential breeding habitat in scrubby margins |
| Whooper Swan (<i>Cygnus cygnus</i>) | ✓ | ✗ | ✗ | ✗ | ✗ | Not recorded in any surveys. | No suitable habitats present within facility in the form of flooded fields/callows for roosting/feeding or grassland for feeding. There is no suitable habitat in the surrounding hinterland either. The arable fields surrounding the existing facility are deemed too small and enclosed by tall treelines and hedgerows. This species like to have a broad, uninterrupted view of the surrounding hinterland, while feeding or roosting. |
| Yellowhammer (<i>Emberiza citrinella</i>) | ✓ | ✗ | ✓ | ✗ | ✗ | Recorded in 2015 surveys only. | Limited suitable breeding habitat present. |

4 IMPACT ASSESSMENT

In the following section the impacts on birds as determined in the EIAR are included verbatim (with grey background and original numbering). Any changes, additions or notes arising from the current assessment based on additional data included in bold below the relevant paragraph.

Thirty-four bird species have been recorded within 10 km of the existing facility (NBDC and NPWS). Evidence of 24 (in 2010), 26 (in 2015), 33 (in 2016) and 58 (in 2019) birds were recorded within the existing facility boundary during field surveys.

Knockharley Landfill Ltd. is applying for permission for the continuation of landfilling activities beyond 2021. Construction of the proposed development will be phased.

Given the potential of some bird species to utilise the existing facility, it is possible that they may be negatively impacted by the proposed development.

4.1 Construction Phase

The following section details the potential impacts to birds during the construction phase of the development in absence of mitigation. The potential impact to birds is considered in section 10.5.2.4 of the EIAR.

4.1.1 General Avifauna

10.5.2.4 Fauna

Potential Impacts on Birds

No Annex I birds of the EU Birds Directive were recorded on the site. Three red-listed species of conservation concern (Meadow Pipit, Herring Gull and Black-headed Gull) were recorded from the subject site. A flock of 200 Herring Gulls was recorded at T3 in January 2016. A total number of 80 were recorded along the same transect during the previous month surveys in December. Herring Gull were recorded along T2 and T3 during the same period in lower numbers. Meadow Pipit were recorded along four of the transects and are a local resident species likely to forage within site on occasion. Eight Amber-listed species of medium conservation were recorded on the site, however the majority of these occurred in low numbers or are nationally abundant in Ireland. A flock of 500 Lesser Black-backed gulls was recorded at T3. The number and abundance of species recorded on the site was entirely typical of the range of habitats present and all are likely to be widespread in the wider environment.

The construction phase of the project will have the highest potential impacts on bird species in terms of disturbance and loss of nesting habitat. As discussed in Section 10.5.2.2 Habitats and Fauna, the construction phase will be short-term and will take place in a phased manner, which will allow disturbed birds to relocate to alternative suitable habitats on and adjacent to the site. During the construction phase a limited amount of hedgerow and treelines will be removed; as will 12.5ha of (in a phased manner); commercial woodland that will be felled whether the proposed development goes ahead or not. Following the construction phase, woodland will be replanted plus additional compensation planting. Whilst felling and replanting will be phased, regrowth of trees will take some time to provide the same level of foraging and nesting habitat for birds. The impact is therefore deemed to be a **Medium-Term Moderate Impact** for birds.

[Addendum: Two Annex I bird species were recorded on existing facility during the 2019 surveys: Peregrine Falcon and Kingfisher. However, in both cases, the birds were not found to be using the facility for breeding and are thought to be passing through only. In addition to the three Red-listed species previously recorded for the EIAR, a further Red-Listed bird was recorded at the existing facility: Grey Wagtail. A further 12 Amber-Listed bird species were also recorded since the EIAR surveys.

There may be some disturbance to bird species within the existing facility during the construction phase of the proposed development. However, this disturbance would be deemed to be short-lived and sporadic, as the proposed development will occur in stages. In addition, there is currently existing ongoing disturbance within the area in terms of daily landfill operations taking place at the facility. There will be no disturbance to bird species listed as qualifying interests for SPA sites. Herring gulls are listed as a qualifying interest for the River Nanny Estuary and Shore SPA (004158). This SPA is 17.4 km east of the existing facility, which is outside of the industry-standard zone of influence of 15 km. Herring Gulls were observed in numbers feeding at the existing facility during November and December winter transects in 2018 and January 2019. There is a hydrological link to the SPA via the River Nanny. However, the SPA is at considerable remove from Knockharley Landfill (instream distance of c. 23 km) and so it is unlikely the proposed development will significantly impact aquatic habitats at the SPA site. Similarly, the Herring Gulls observed during transect surveys were feeding in the face of considerable disturbance by vehicles. Therefore, it is highly unlikely the proposed development will significantly impact Herring Gull feeding in a negative way. Construction impacts on Herring Gull will therefore be *Temporary* and *Not significant*.

Further details for other birds listed as qualifying interests for nearby SPAs are provided in the appropriate sections below.

While there will be some alteration to habitats at the facility, with some land-take in the area of the proposed IBA Facility, the proposed Screening Berms with new replanting around this facility will reduce, somewhat, the habitat loss in this area.

Habitats predicted to be lost are discussed in further detail in the companion Botanical and Habitat report. Habitats selected as key ecological receptors include: Wet Grassland/Dry Meadows and Grassy Verges Mosaic (GS4/GS2), Dry Meadows and Grassy Verges (GS2), (Mixed) Broadleaved Woodland (WD1), Conifer Plantation (WD4), Mixed Broadleaved/Conifer Woodland (WD2) and Ornamental/Non-native Shrub/Scrub Mosaic (WS3/WS1).

The Permitted Landfill Cells to be constructed are already being excavated and lined, so further construction in this area will be minimal. The habitat has already been altered so there will be no further loss to bird habitat.

Spoil and Bare Ground (ED2) is the only habitat type where any bird species listed as a qualifying interest of a SPA have been recorded foraging. Herring Gulls, which are a qualifying interest of the River Nanny Estuary and Shore SPA (004158) have been recorded foraging (104 no. in winter and 110 no. flying over during the summer) in this habitat at the centre of Knockharley Landfill. It is unlikely that the existing facility provides important *ex-situ* foraging habitat for this species, as gulls are renowned generalists, foraging in a wide range of habitats. This habitat type is also very common in the wider landscape (e.g. ploughed fields not yet tilled) and so an excess of alternative foraging locations exist. Therefore, it is not envisaged that the loss of Spoil and Bare Ground (ED2) will have a significant negative effect on Herring Gulls from the River Nanny Estuary and Shore SPA.

There are no proposed habitat changes to the existing grassed-over landfill cells that have been shown to be important for certain bird species such as Stock Dove, Tree Sparrow and Stonechat, so no habitat loss will be envisaged in this area. As these landfill cells lie adjacent to existing landfill cells that are currently being filled, the level of disturbance in this area will remain similar to current levels.]

4.1.2 Breeding Raptors

The Buzzard roosting site recorded in 2010 on the site is located outside of the footprint of the proposed development and will not be impacted by this project. Buzzards appear to be common on the site and do not appear to be impacted by the current levels of activity on the existing landfill site as evidenced by the observations of Buzzard in March 2015.

[Addendum: Annex I-listed Peregrine Falcon was observed flying through the existing facility on a single occasion during January 2019 winter transect surveys. However, there was no evidence of Peregrine and other raptors (including Buzzard) breeding within the facility, during the summer bird surveys. The construction phase of the development will take place in stages, over an extend

period of time. The construction phase will be carried out in conjunction with ongoing regular landfill operations that occur on a daily basis which currently result in localised disturbance due to noise and vehicular movement.

Annex I Peregrine Falcon is not listed a qualifying interest for either of the SPA sites within 15 km of the existing facility. They also favour cliffs and quarries for breeding sites; neither of which are present at Knockharley Landfill. It therefore extremely unlikely that they will be impacted by the proposed development and there are no European sites where they are listed as qualifying interests within the industry-standard 15 km zone of influence. Construction impacts for Peregrine Falcon are envisaged to be *Temporary* and *Imperceptible*.]

4.1.3 Breeding Waders

The constructed wetland provides nesting habitat for Coot and probably a range of other aquatic birds and this habitat will not be impacted by the proposed development.

[Addendum: No breeding waders were observed within the existing facility during the 2019 summer breeding wader survey and other bird surveys. As a result, there will be no impact on breeding wader species during the construction phase of the development.]

4.1.4 Kingfisher

The constructed wetland provides nesting habitat for Coot and probably a range of other aquatic birds and this habitat will not be impacted by the proposed development.

[Addendum: There was one sighting of Annex I-listed Kingfisher during the summer bird surveys. This occurred at the existing southern water attenuation pond and associated wetland. This Integrated Constructed Wetland system was constructed to a very high professional standard and represents the best example of habitat creation within the existing facility, in terms of habitat for birds and other taxa, such as Dragonflies and Damselflies (Odonata).

A single kingfisher was observed in flight on the Flemingstown (Knockharley) Stream during a walkover survey as part of aquatic surveys (see Tritirus, 2019 for further details). Given the poor water quality and overgrown nature of the stream, the bird likely utilised the nearby existing surface water attenuation pond where broader prey resource existed (e.g. three-spined stickleback, macro-invertebrates, amphibians etc).

Like the Kentstown and Veldonstown Stream, the Flemingstown supported three-spined stickleback locally but nevertheless offered poor water quality and poor overall fisheries potential, thus being less attractive to kingfisher. Although not recorded along the River Nanny, the river provided better foraging habitat in addition to a greater number of perches (for feeding) between sites 3 and 4. Overall the study area offered poor nesting potential for kingfisher given heavily scrubbed over banks with no nesting sites recorded during the walkover survey.

There are no changes proposed for this system in the proposed development plan, and any proposed activities that will take place during construction are at the north of the existing facility, at remove from the southern attenuation pond. If Kingfishers were found to be breeding at this location during the construction phase of the development, it is predicted there will be a *Temporary, Imperceptible impact* on this species at this location.

Kingfishers are listed as a qualifying interest of the River Boyne and River Blackwater SPA (site code 004232). This site is approximately 5 km to the north east of the existing facility. It is highly unlikely that any construction activities within the existing facility will impact this SPA owing to distance and the fact that it is within a different catchment area. The SPA is within the Boyne catchment and the existing facility is within the Nanny-Delvin catchment. Thus, no hydrological link exists between the two locations and so there is no mechanism by which the proposed development can impact water quality at the SPA. Furthermore, the Kingfisher observed at the existing facility during site surveys was judged to be a transient, passing through but not breeding or regularly feeding at the existing facility. There is no suitable breeding habitat at the existing landfill. Even if there were, Kingfishers are highly territorial. During the breeding season, they typically maintain territories 1 km in length (Fry *et al.* 1999).

As the River Boyne and River Blackwater SPA is 5 km from the existing facility, it is highly unlikely any Kingfishers within the SPA would use the existing facility for breeding. Therefore, it is not envisaged that there will be any significant negative effects on Kingfishers within the River Boyne and River Blackwater SPA (site code 004232).

The proposed development plan entails creation of a second Integrated Constructed Wetland to the north of the proposed IBA Facility. There may be some disturbance to some woodland bird species during this operation, but the long-term benefits, in terms of a second wetland system located within the existing facility, outweigh any short-term disturbance to birds currently utilising this area.]

4.1.5 [Barn Owl](#)

[Addendum: No Barn Owls were observed within the existing facility during the summer Barn Owl Survey and other bird surveys. As a result, there will be no impact on Barn Owls during the construction phase of the development.]

4.2 Operational Phase

The following section details the potential impacts to birds during the operational phase of the development in absence of mitigation. The potential impact to birds is considered in section 10.5.3.4 of the EIAR.

4.2.1 [General Avifauna](#)

10.5.3.4 Fauna

Mixed deciduous and coniferous trees felled will be replaced with native broadleaved trees which will be of higher ecological value to local wildlife. This woodland planting will provide cover and foraging habitat for local fauna. As these trees mature, they will also provide nesting habitat for birds.

This woodland will be commercial forestry and will therefore be felled in the future. Planting of deciduous woodland will have a **Positive Short-Term Moderate impact** on local fauna.

[Addendum: There will be disturbance within the area of the Permitted Landfill Cells during the operational phase. Over time, when the permitted landfill cells reach capacity, these cells will be grassed-over and will become a similar habitat to the constructed landfill area that currently support Stock Dove, Stonechat and Tree Sparrow, so it is possible that numbers of these species will increase within the existing facility, as this additional habitat matures. Thus, for these species there will be a **Positive Short-Term Moderate impact**.]

4.2.2 [Breeding Raptors](#)

[Addendum: It is thought that the proposed developments will be of a similar nature to the current landfill operations in terms of noise, vehicular activity and disturbance that currently take place at the existing facility and so will not have a significant impact on birds of prey flying over the existing facility.

The details of the existing and amended sections of powerlines are provided in Figure LW14-821-01-P-0000-003, Volume 4 of the main Proposed Site Layout Plan.

Detailed descriptions are also provided in Chapter 2 (Sections 2.1.1 and 2.2), Volume 2 of the EIAR. It is proposed to bring a new overhead supply to the proposed substation on the north west corner of the permitted development (Phase 7). This new supply will be an overhead 10kV/20kv line (subject to ESB recommendations) mounted on wooden poles 6 m to 8 m above existing ground levels parallel to and offset by approximately 7.5 m (subject to ESB recommendations) from the existing 220 KVA overhead pylons. The powerline shall be along the same corridor as the existing powerline at that location.

An existing section of overhead lines within the footprint of the proposed IBA shall require a minor diversion around the southern edge of the area. The existing overhead line located to the north of the administration building will be relocated to the south of the proposed IBA development. The power lines will, subject to ESB recommendations, be laid over ground mounted on wooden poles 6 m to 8 m above existing ground levels or in underground ducts. The alignment of both options will be parallel to and offset from the existing site access road by approximately 7.5 m to the north.

These proposed overhead lines provide only marginal diversions adjacent to existing overhead lines within the site. It must also be noted that there is a network of powerlines running through and around the perimeter of the landfill site currently and therefore these marginal diversions adjacent to existing lines will not be traversing new areas of habitat where powerlines were not previously present. Overall the proposed development shall result only in a marginal realignment of a small section of overhead powerlines within the site.

The presence of additional power lines may have a *Long-Term, Imperceptible impact* on birds of prey frequenting the existing facility. Further observations, including vantage point surveys may have to be carried out in order to determine if there are any adverse effects of the additional power lines on birds of prey flying over the area.

None of the raptors observed during surveys to date were recorded breeding within the existing facility. The only Annex I raptor observed in 2019 was Peregrine Falcon, but this bird was passing through the site and was not using it for feeding or breeding. As explained previously, no SPA sites where Peregrine Falcon is listed as a qualifying interest are present within 15 km of the existing facility. Coupled with the lack of suitable feeding/breeding habitats, it is extremely unlikely Peregrine Falcon will be impacted by the proposed development. Operational impacts for Peregrine Falcon are envisaged to be *Temporary and Imperceptible.*

4.2.3 [Breeding Waders](#)

[Addendum: There will be no impact on breeding waders during the operational phase, as no breeding waders were observed during any of the bird surveys.]

4.2.4 [Kingfisher](#)

[Addendum: A single Kingfisher was observed during active landfill operations that are currently taking place, including frequent vehicular activity close to the wetland. As there are no proposed developments planned at this location, future developments will have an *Imperceptible Impact* on this species.

Kingfishers are listed as a qualifying interest of the River Boyne and River Blackwater SPA (site code 004232). This site is approximately 5 km to the north east of the existing facility. It is highly unlikely that any construction activities within the existing facility will impact this SPA owing to distance and the fact that it is within a different catchment area. The SPA is within the Boyne catchment and the existing facility is within the Nanny-Delvin catchment. Thus, no hydrological link exists between the two locations and so there is no mechanism by which the proposed development can impact water quality at the SPA. Furthermore, the Kingfisher observed at the existing facility during site surveys was judged to be a transient, passing through but not breeding or regularly feeding at the existing facility. There is no suitable breeding habitat at the existing landfill. Even if there were, Kingfishers are highly territorial. During the breeding season, they typically maintain territories 1 km in length (Fry *et al.* 1999). As the River Boyne and River Blackwater SPA is 5 km from the existing facility, it is highly unlikely any Kingfishers within the SPA would use the existing facility for breeding. Therefore, it is not envisaged that there will be any significant negative effects on Kingfishers within the River Boyne and River Blackwater SPA (site code 004232).

When the second Integrated Constructed Wetland to the north of the existing facility is created, it will complement the existing wetland system at the south of the existing facility and will further enhance the existing facility, in terms of habitat creation and additional wetland bird assemblage within the existing facility, including Kingfisher.]

4.2.5 Barn Owl

[Addendum: There will be no impact on Barn Owls during the operational phase, as no Barn Owls were observed during any of the bird surveys.]

4.3 Decommissioning Phase

On cessation of waste acceptance at the facility, a restoration and aftercare plan will be put in place (please see Chapter 2 Description of the Proposed Development in Volume 2 of the EIAR) and any structures not required as part of the restoration and aftercare plan will be removed.

[Addendum: During the removal of structures and restoration works there will be local *Short-Term Slight impacts* due to disturbance of birds in the absence of mitigation. There is not predicted to be any effects on bird species listed as qualifying interests in nearby SPAs.]

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5 MITIGATION MEASURES

5.1 General Avifauna

Construction Phase

10.6.1.1 Fauna and Flora

- In terms of habitats, treelines and hedgerows will be retained where possible. Where retention is not possible vegetation clearance and tree felling will be carried out outside of the bird breeding season (the bird breeding season is between 1st March – 31st August).
- Construction operations will take place during the hours of daylight to minimise disturbances to nocturnal mammal species, roosting birds or active nocturnal bird species.

10.6.2 Operational Phase

- Excessive additional lighting around the site will be avoided. Lighting will be kept to minimum safe levels to reduce disturbance to nocturnal mammals and birds. Directional lighting will be used to prevent light disturbance in the surrounding area.

[Addendum: With regard to the general avifauna that has been recorded at the facility, no additional mitigation beyond that in the EIAR is proposed. However, consideration should be given to the important bird species recorded in the area of the grassed-over landfill at the centre of the existing facility.]

The numbers of Tree Sparrow, Stock Dove and Stonechat recorded in this area were low, and this habitat may only support these numbers. In addition, these species were present before any surveys took place and colonised this area because the right conditions were created/present, such as food and cover. Therefore, it is difficult to suggest mitigation for some of the species such as Stock Dove and Stonechat.

However, with regard to Tree Sparrow, it is known that they nest colonially. The provision of a cluster of nest boxes as an enhancement measure within the facility to further attract this species is recommended. The location to be decided, by an qualified ecologist.]

5.2 Breeding Raptors

[Addendum: There is no mitigation proposed for breeding raptors, as there was no evidence of raptors breeding at the existing facility.]

5.3 Breeding Waders

[Addendum: There is no mitigation proposed for breeding waders as there was no evidence of waders frequenting or breeding at the existing facility.]

5.4 Kingfisher

[Addendum: The proposed creation of an additional Integrated Constructed Wetland within the existing facility, while in itself part of the development plan and important for the facility, represents the best mitigation that could be adopted for the existing facility, and more than offsets any habitat loss or alteration to existing habitats that may occur during the implementation of this project.]

The results of the summer bird surveys and observations at the wetland at the south of the existing facility show the additional diversity that occurs when the right ecological conditions are created and, more importantly, maintained, as this wetland is.

The implementation of the mitigation measures to protect water quality shall also benefit Kingfisher prey items downstream.]

5.5 Barn Owl

[Addendum: While no Barn Owls were recorded within the existing facility during any of the summer bird surveys, consideration should be given to the erection of a Barn Owl nest box in the area of the farm, located at the northeast of the facility.]

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6 RESIDUAL IMPACTS

[Addendum: Taking into consideration the updated surveys and mitigation measures proposed, it is reconfirmed that there will be no significant residual impact to birds as per the EIAR.]

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7 CONCLUSION

Avian surveys were continued during 2019 as required by the 2014 EIA Directive 2014/52/EU. Thirty-four bird species have been recorded within 10 km of the existing facility (NBDC and NPWS). Evidence of 24 (in 2010), 26 (in 2015), 33 in 2016 and 55 (in 2019) bird species were recorded within the existing facility boundary during the surveys.

No bird species have the potential to be significantly impacted by the proposed developments.

No bird species listed as qualifying interests for nearby SPA sites have the potential to be negatively affected by the proposed development owing to a combination of distance, location within different catchment areas, existence of alternative foraging habitats within wider landscape and lack of suitable habitats for breeding and feeding at the existing facility.

During the operational phase, birds are likely to continue using the facility and the new woodland created will provide habitat for cover and foraging. It is considered that the operational phase of the development will not result in a significant negative impact on any bird species.

Taking into consideration the results of the continued bird surveys, the habitat preferences of the birds recorded and the habitats within the existing facility and in the surrounding landscape, it can be concluded that the proposed development will not result in a significant negative residual impact on bird species.

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Appendix 1

Site Investigation Results

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Table A: Vantage Point Survey Details

| Survey Type | VP no. | Date | Observer | Start Time | End Time | Cloud | Visibility | Rain | Wind |
|---------------|--------|------------|----------------|------------|----------|-------|------------|-------------------|---------|
| Vantage Point | 1 | 21/06/2019 | Joseph Adamson | 10:00 | 16:00 | 2/8 | Excellent | Dry | F2 SW |
| Vantage Point | 1 | 08/07/2019 | Joseph Adamson | 10:00 | 16:00 | 8/8 | Excellent | Dry | F<1 ESE |
| Vantage Point | 1 | 07/08/2019 | Joseph Adamson | 10:00 | 16:00 | 8/8 | Excellent | Occasional shower | F2-3 SW |

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Table B: VP Survey Results (flight lines)

| Survey type | Species | Flightpath number | Date | VP | Start time | End time | Observer | Cloud | Visibility | Rain | Wind | Bird notes |
|--|-------------|------------------------|------------|-----|------------|----------|----------------|-------|------------|-------------------|---------|--------------------------------|
| NO FLIGHT LINES WERE RECORDED DURING VP SURVEYS – RESULTS SHOWN BELOW ARE FOR BIRDS RECORDED DURING ADDITIONAL SURVEYS | | | | | | | | | | | | |
| Breeding bird transect | Buzzard | No flightpath recorded | 21/06/2019 | N/A | N/A | N/A | Joseph Adamson | 2/8 | Excellent | Dry | F<1 ESE | Perched on telegraph pole |
| Breeding bird transect | Buzzard | N/A | 21/06/2019 | N/A | N/A | N/A | Joseph Adamson | 2/8 | Excellent | Dry | F<1 ESE | Mobbed by crows |
| Breeding waders | Sparrowhawk | N/A | 07/08/2019 | N/A | N/A | N/A | Joseph Adamson | 8/8 | Excellent | Occasional shower | F2-3 SW | Near southern attenuation pond |

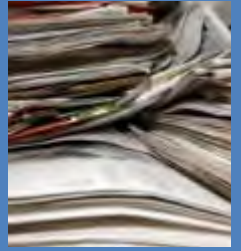
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Appendix 4

Botanical and Habitat Report

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KNOCKHARLEY LANDFILL BOTANICAL AND HABITAT SURVEYS 2019

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CREATED FOR:

Knockharley Landfill Ltd.



CREATED:

October 2019

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1 INTRODUCTION

This report details the results of habitat surveys carried out at Knockharley Landfill site during summer 2019. These survey was undertaken to continue the ongoing environmental works at Knockharley Landfill in accordance with the EIA Directive 2014/52/EU. This report should be read in conjunction with Chapter 10 of Volume 2 of the Environmental Impact Assessment Report for Proposed Development at Knockharley Landfill (Fehily Timoney and Company, 2018) (EIAR). Knockharley Landfill Ltd. proposes to further develop the existing facility as per the 2018 application for permission made directly to An Bord Pleanála. Intensive surveying of plots within the footprint of proposed development and an extensive walkover habitat surveys encompassing the entire study area were undertaken. All species of flora including vascular plants, mosses and lichen (if present) were identified and recorded. Suitable habitats were also searched for lichens. The surveys were undertaken to confirm the information contained in the EIAR.

1.1 Soils, Historical Habitats and Management

This section has been included to give an overview of the history of land use and habitats present at the Knockharley Landfill site. This is relevant when considering the habitats currently on site in terms of their origin, age and development.

The predominant soil type covering the site according to Teagasc's Irish Soil Information System is "fine loamy drift with limestones" (soil series Straffan 0700ST), which is a clay loam with neutral pH in the upper horizons, becoming more basic as the bedrock is approached. River alluvium is present in some areas of the site (soil series Boyne 0500SBO), which is a silty river alluvium falling within the sub-group "typical alluvial gleys". Historical 6-inch mapping (1837-1842) (plate 1 below) does not show any wooded areas within the site. A number of fields forming the eastern flank of the site are shown as containing a mix of broadleaved and coniferous trees in mapping from 1888-1913(see plate 2 below).

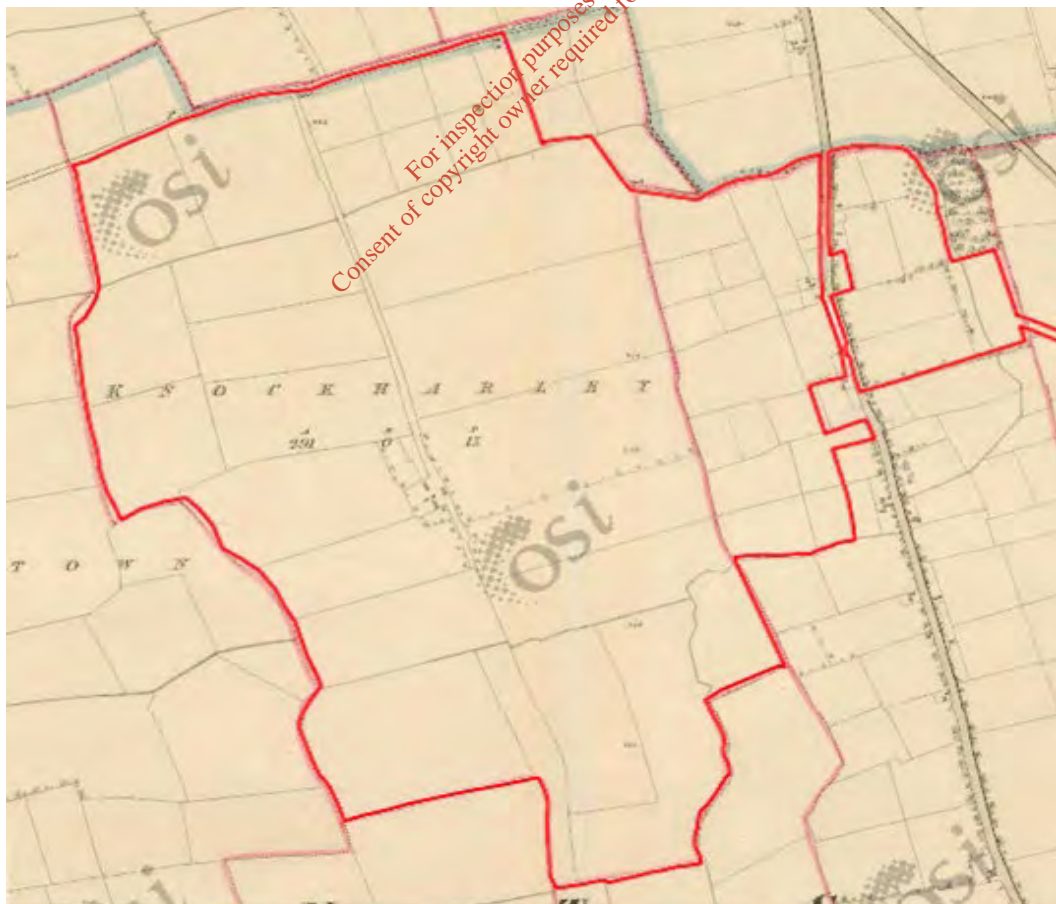


Plate 1: Historical Mapping of Landfill Site (1837-1842)

(Source: <http://map.geohive.ie/mapviewer.html>; accessed 03/10/2019)

Historical 25-inch mapping (1888-1913) shows that parts of the site were wooded during this period (see plate 2 below). These blocks of woodland were confined to within pre-existing field boundaries, where no woodland was depicted on previous (1837-1842) mapping, indicating their artificial origin i.e. a plantation.

The composition of the majority of these woodlands as indicated on these maps was mixed broadleaved/conifer (see inset to left in plate 2). Only one parcel of broadleaved woodland is depicted in the area during this time(right inset in plate 2).

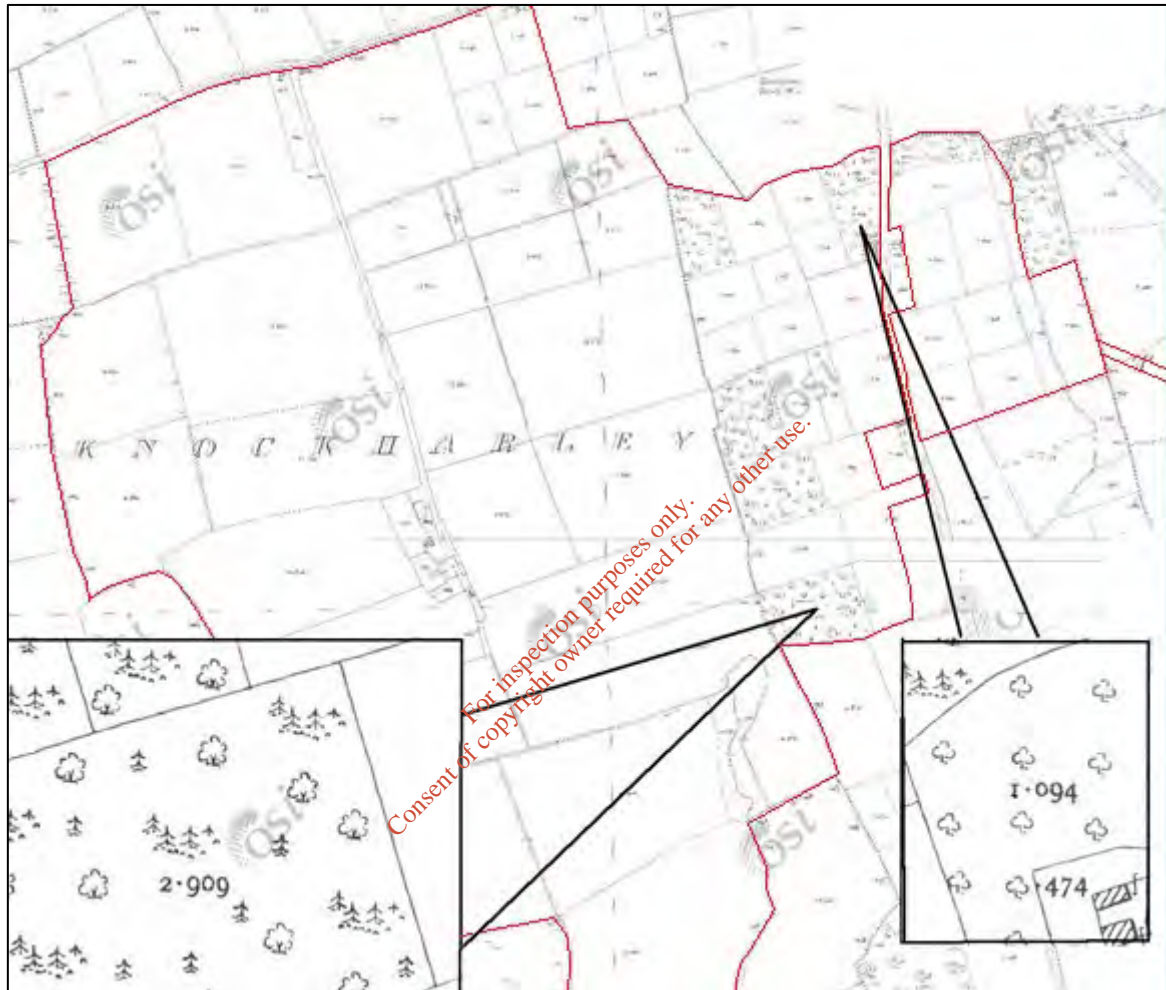


Plate 2: Historical Mapping of Landfill Site (1888-1913)

(Source: <http://map.geohive.ie/mapviewer.html>; accessed 03/10/2019)

Examination of historical aerial imagery indicates the land within the site was used for a mix of intensive arable and pastoral farming up until at least the year 2000. The imagery from this year shows recently planted arable crops, uniform pastures and fields with exposed soil which indicates re-seeding of pastureland or tilled land in preparation for planting of arable crops. There are no areas of woodland present within the site in aerial imagery from the year 2000 (see plate 3 below).

Aerial imagery from 2005 shows the landfill activity onsite, with extensive areas of stripped soil, excavations and trackways. Outside of constructions areas, the surrounding habitats remained similar to that in 2000, with arable and pasture land dominating, and no evidence of woodlands (see plate 4 below).



Plate 3: Satellite Imagery (2000)

(Source: <http://map.geohive.ie/mapviewer.html>; accessed 03/10/2019)



Plate 4: Satellite Imagery (2005)

(Source: <http://map.geohive.ie/mapviewer.html>; accessed 03/10/2019)

Within the landfill site boundary no land parcels contained woodland in the era leading up to construction of the landfill. Planting with commercial forestry has taken place since landfill operations commenced. The next available set of aerial imagery (2005-2012) (plate 5 below) has a broad temporal range but shows that forestry plantations surrounding the landfill were established during this timeframe. The recolonisation by grassy vegetation of areas stripped during construction and cessation of intensive agricultural management of two fields to the north of the existing landfill (within footprint of permitted extension) can also be seen in this imagery.



Plate 5: Satellite Imagery (2005-2012) including site boundary

(Source: <http://map.geohive.ie/mapviewer.html>; accessed 03/10/2019)

The mapping and aerial imagery referenced was accessed through Ordnance Survey Ireland's online GIS platform *Geohive* at <http://map.geohive.ie/mapviewer.html> (accessed 03/10/2019).

Taken collectively, these images and mapping shows a history of the development on the site since 2000 and shows that no semi-natural habitats occupied the open spaces within the site in the era prior to construction of the landfill. They also show that the grassland communities currently occupying the site developed recently following disturbance and cessation or intensification of management, and that the woodlands within the site were recently planted.

The satellite image post-2012 shown in plate 6 below shows continuing site clearance works associated with the consented landfill development. The aerial photograph below (plate 7) shows the artificial character of the grasslands near the site offices soon after the facility was constructed.



Plate 6: Satellite Imagery (post-2012) including site boundary
(Source: ESRI/ArcMap accessed 09/10/2019)



Plate 7: Aerial photograph showing artificial character of grasslands around landfill offices after construction
(From EIAR)

1.2 Survey Details

Surveys were undertaken in favourable weather conditions (dry and bright with good visibility), when plants were in suitable condition for identification with sufficient vegetative and reproductive material available to examine.

Table 1: Survey Details

| Date | Surveys Undertaken | Weather | Surveyor |
|------------|---|---|----------------|
| 31/07/2019 | Habitat survey, grassland quadrats/relevés | Dry; Wind F3; Cloud 5/8; Visibility Excellent | Ben O'Dwyer |
| 01/08/2019 | Habitat survey, plantation woodland relevés | Dry; Wind F2-3; Cloud 4/8; Visibility Excellent | Ben O'Dwyer |
| 26/08/2019 | Habitat survey | Dry; Wind F3; Cloud 2/8; Visibility Excellent | Joseph Adamson |

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2 METHODOLOGY

2.1 Habitat and Botanical Surveys

All flora present were identified, and habitats were classified according to Fossitt (2000) "A Guide to Habitats in Ireland" (Fossitt, 2000) with habitat mapping undertaken in accordance with "Best Practice Guidance for Habitat Survey and Mapping" (Smith et al., 2011).

Ortho-photographs of the landfill site were annotated in the field to delineate each habitat type identified. Target notes were recorded for each habitat polygon and for features of interest recorded during the survey. The minimum size of habitats mapped was 400m² for polygons and 20m for linear habitats, in accordance with the recommended guidance (Smith et al., 2011). The position of notable small habitats and features of interest was marked using a GPS and recorded as points of interest. All plant species in each habitat type were recorded, enabling a full species list for the site to be compiled.

To obtain greater detail, quadrats and relevés were used to record vegetation in areas within the footprint of the proposed extensions to the east of the existing (capped) landfill and consented landfill cells.

2.1.1 Grassland Habitats

For grassland areas, the methodology detailed in "The Irish semi-natural grasslands survey 2007-2012" (O'Neill et al., 2013) was used, whereby the number of 2 x 2m quadrats required was determined by the area of habitat present (e.g. 4 quadrats per area >0.25-4 ha). Quadrat locations were assigned randomly prior to survey.

All species were identified and percentage cover was recorded for each species. The percentage cover and median height for graminoids and herbs was also recorded for each quadrat. Where randomly assigned quadrats did not adequately capture the habitats present, additional relevés were surveyed. This approach was used twice. The use of both randomly assigned plots and subjectively located relevés is in accordance with *The Irish semi-natural grasslands survey* methodology.

2.1.2 Plantation Woodland Habitats

Survey of plots in woodland areas was undertaken following the methodology detailed in the "National Survey of Native Woodlands 2003-2008" (Perrin et al. 2008), whereby one 10 x 10 m Relevé was recorded in each habitat type present in woodland blocks. All species were identified and recorded. Canopy and understory cover, stem density and diameter at breast height for mature trees, natural regeneration, dead wood (cover and characteristics) and characteristics such as grazing and invasive species were also recorded.

2.1.3 Flora Keys and Field Guides

The following keys and field guides were used to identify flora species:

- Webb's An Irish Flora (8th edition) (Parnell and Curtis, 2012)
- The Wildflower Key (2nd edition) (Rose/O'Reilly, 2006)
- Wild Flowers of Britain and Ireland (Blamey et al., 2003)
- Identification Guide to Ireland's Grasses (Fitzpatrick et al., 2016)
- Grasses, Sedges, Rushes and Ferns of the British Isles and Western Europe (Rose, 1989)
- Grasses: A Guide To Their Structure, Identification, Uses and Distribution (Hubbard, 1992)
- Mosses and Liverworts of Britain and Ireland a field guide (Atherton et al., 2010)

2.1.4 Analysis

Article 17 Habitats Directive Reports from 2013 and 2019 (The Status of EU Protected Habitats and Species in Ireland – Habitat Assessments) were used to examine whether any of the habitats present within the footprint of proposed development correspond to Annex 1 habitats. The Article 17 reporting document from 2013 (NPWS, 2013) was also used as this contains more specific criteria for assignment, including a minimum number (7) of characteristic species and a list of 'high-quality' species, at least one of which must be present. The same typical species list is given in Article 17 reporting documentation from 2019 (NPWS, 2019), but no minimum number of these are specified, and none are identified as 'high-quality'. These species lists are included in Appendix 1, along with indications of which were recorded in the semi-natural grasslands within the footprint of the proposed development at Knockharley Landfill.

The quadrats and relevés recorded in the semi-natural grasslands within the proposed development footprints were also analysed using ERICA (Engine for Relevés to Irish Communities Assignment).¹

In addition to assigning communities to more clearly defined groups than the habitats described in Fossitt (2000), the IVC also ties in with the Article 17 (2019) *Status of EU Protected Habitats and Species in Ireland – Habitat Assessments* since the specific IVC communities into which Annex 1 habitats fit are given in this document. The results of this analysis are included in Appendix 2, along with a brief discussion, and commentary on their relationship (if any) with Annex 1 habitats.

The Interpretation Manual of European Union Habitats (EC, 2013) was also consulted.

2.2 Impact Assessment

EPA Guidelines (2017) were used to assess the potential impact and resulting effect of the proposed development on habitats and flora.

In line with the EPA Guidelines (EPA, 2017), the following terms are defined when quantifying duration:

- Momentary: from seconds to minutes
- Brief: up to 1 day
- Temporary: up to 1 year
- Short-term: from 1-7 years;
- Medium-term: 7-15 years;
- Long-term: 15-60 years; and
- Permanent: over 60 years.

The impacts were assessed under a number of parameters such as magnitude, extent, timing, frequency, duration and reversibility. The impact significance criteria (EPA, 2017) as set out in Table 2 are used where applicable. A glossary of impacts is further outlined in Appendix 10.3 Volume 3 of the EIAR.

¹ ERICA is an online analysis tool for assigning habitats to the communities of the Irish Vegetation Classification (IVC) using vegetation data available through the National Biodiversity Data Centre (NBDC) website: <http://www.biodiversityireland.ie/projects/national-vegetation-database/irish-vegetation-classification/erica/>.

Table 2: Significance of Effects Criteria

| Impact Significance | Criteria |
|---------------------|--|
| Imperceptible | An effect capable of measurement but without significant consequences |
| Not significant | An effect which causes noticeable changes in the character of the environment but without significant consequences |
| Slight | An effect which causes noticeable changes in the character of the environment without affecting its sensitivities |
| Moderate | An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends |
| Significant | An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment |
| Very significant | An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment |
| Profound | An effect which obliterates sensitive characteristics |

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3 DESKTOP STUDY

A search for records of rare and/or protected flora and lichens in the 10 km grid square (N96) overlapping the Knockharley Landfill site was carried out using the National Biodiversity Data Centre (NBDC) website on 8th October 2019. This returned no records of rare or protected vascular plants, and no records of any species of lichen.

The NPWS map viewer was also searched for records of rare/protected species within grid square N96 and no records were returned. A data request for rare and protected species within 10km of the existing facility was submitted to the NPWS on 8th October 2019. This data was received from the NPWS on the 11th October 2019. There were records of rare or protected flora within the 10km grid square (N96) encompassing the proposed development.

Of the 81 species of bryophyte (mosses and liverworts) recorded within grid square N96, one record was of a rare/threatened species which is slender pocket-moss *Fissidens exilis*. The record is from 1978, and while geographical resolution is low at 10km, the place name Somerville is given, which corresponds to an area c. 500m south-east of the landfill site. *F.exilis* is assessed as Vulnerable in Lockhart et al's 2012 red list '*Rare and threatened bryophytes of Ireland*'.

According to the British Bryological Societies '*Mosses and Liverworts of Britain and Ireland – a field guide*' *F.exilis* inhabits neutral or acidic loam and clay soils in low-lying woodland habitats, on sheltered (often shady) banks, molehills, streamsides, and in damp fields and grassland.

The online mapping tool 'FPO (Flora Protection Order) Bryophytes Map Viewer <http://dahg.maps.arcgis.com/apps/webappviewer/index.html?id=71f8df33693f48edbb70369d7fb26b7e> details the locations of rare and threatened bryophyte species listed on the Flora Protection Order (2015). None of these locations are within or surrounding the proposed development site. The closest sites located in Baltray, Co. Louth c. 19 km to the east of the proposed development, where Pointed Beard-moss *Didymodon acutus* is present. The records for this species in the east of Ireland are limited to the Baltray and Clogherhead areas.

Six lichen species are listed in Kingston's (2012) '*Checklist of protected & rare species in Ireland*'. Of these, scrambled-egg lichen *Fulgensia fulgens* is the only lichen species listed on the Flora Protection Order. This species typically inhabits well-lit calcareous dune systems of the south east of Ireland. It is found only at Ballyteigue Burrow in Co. Wexford.

The remaining five lichen species identified by Kingston (2012) are of the genus *Cladonia* and are listed in Annex V of the EU Habitats Directive (the harvesting of Annex V species is restricted).

- *Cladonia arbuscular* is a common lichen species on acid heathlands, peat, moors and areas of dune – none of these habitats occur at Knockharley.
- *Cladonia ciliata* is common on dunes, moors, heathland and scree - none of these habitats occur at Knockharley.
- *Cladonia portentosa* is common on heaths and peat moors – none of these habitats occur at Knockharley.
- *Cladonia rangiferina* is common in highland areas and on lowland heaths along the coasts – there are no heath habitats at Knockharley.
- *Cladonia azorica* is rare and under recorded in Ireland and is only known from the Dingle peninsula in Co. Kerry.

4 HABITATS AT KNOCKHARLEY LANDFILL SITE

The habitats present on site are described and categorised according to Fossitt's (2000) habitat classification system. These predominantly terrestrial habitats are composed mainly of grasslands and blocks of plantation woodland. Hedgerows and treelines, areas of bare and recolonising ground, aquatic habitats and built structures are also present. Several common mosses are present as detailed below; the Vulnerable slender pocket-moss *F. elixis* is not present on site. No lichens are present on site.

Habitats are mapped in Figure 1. Figure 2 shows the locations of the intensive survey plots within the grassland and woodland habitats within the footprint of proposed infrastructure. The results of these quadrat and relevé surveys are detailed in Appendix 3 (Grasslands) and Appendix 4 (Woodlands). Photos of each plot accompany survey results and additional images are included in Appendix 5.

Please note that within the main body of this report, scientific names are given in the first instance only and thereafter the common name is used. Where species belong to the same genus, the first mention is named fully while for any following the genus is abbreviated (e.g. *Cirsium arvense* followed by *C. palustre*).

It should be noted that the EPA's name for streams are used in this report. As such, the Flemigstown 08 stream discussed in this report is the same watercourse as the 'Knockharley Stream' referred to in the EIAR.

4.1 Changes to the Habitat Map

Following surveys in 2019, a number of updates were made to the habitat map based on the survey data obtained. This section should be read in conjunction with the updated habitat map Figure 1 and in conjunction with Chapter 10 of the EIAR.

Changes between the current and previous habitat maps (EIAR) occurred for the following reasons:

1. natural processes (grasslands being left unmanaged and reverting to more semi-natural states), agricultural management, and
2. ongoing vegetation and topsoil clearance and spoil deposition associated with the construction of permitted landfill cells have resulted in realised changes on the ground.

Updated habitat maps were prepared to reflect all habitat changes on site. Previously areas were classified according to the dominant habitat type only. These habitat areas have now been split into mosaic-like patterns more reflective of the complexity of these discrete areas, for example, the habitats surrounding the existing surface water attenuation pond.

A number of grassland areas have been re-classified from GA1/GS4 Improved Agricultural Grassland/Wet Grassland Mosaic and GS4 Wet Grassland to GS4/GS2 Wet Grassland/Dry Meadows and Grassy Verges Mosaic due to the lack of management which has resulted in these areas becoming more natural in character, and increased in species richness. Similarly, fields to the south of the landfill offices formerly classified as GA1/GS4 Improved Agricultural Grassland/Wet Grassland Mosaic and GA1 Improved Agricultural Grassland have been allowed to revert to a more natural state, resulting in development of GS2 Dry Meadows and Grassy Verges.

Other areas of grassland have become less natural due to agricultural management, with fields which were formerly classified as GA1/GS4 Improved Agricultural Grassland/Wet Grassland Mosaic and GS4 Wet Grassland now corresponding to GA1 Improved Agricultural Grassland following re-seeding. A fringing area of GS4/GS2 Wet Grassland/Dry Meadows and Grassy Verges Mosaic remains around one of these fields.

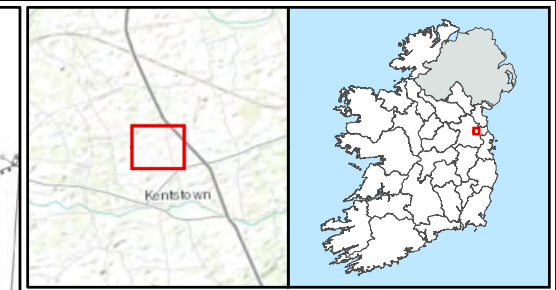
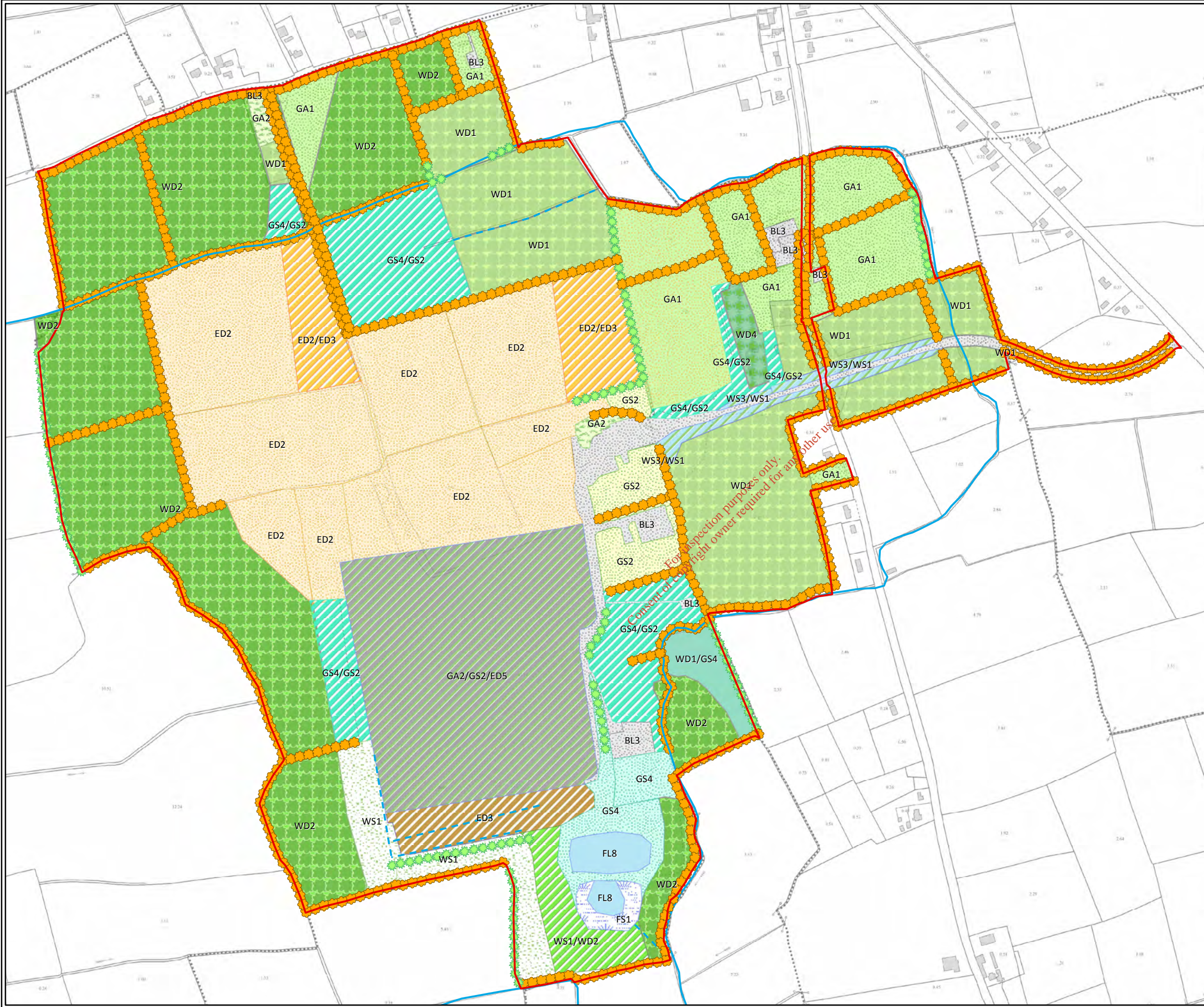
A number of fields within the footprint of the consented landfill which is under construction landfill cells have been cleared, resulting in a change in habitat type from GA1/GS4 Improved Agricultural Grassland/Wet Grassland Mosaic and GS4 Wet Grassland to ED2 Spoil and Bare Ground and ED2/ED3 Spoil and Bare Ground/Recolonising Bare Ground Mosaic. Loss of treelines and hedgerows has also occurred in these areas as part of the development of the consented landfill.

An area previously categorised as GS4 Wet Grassland at the south-western corner of the capped landfill has developed into scrub.

In addition to these updates, a number of new habitat features were also recorded; these are:

- Classification of the capped landfill which was previously excluded from the habitat map as: Amenity Grassland/Dry Meadows and Grassy Verges/Refuse and Other Waste GA2/GS2/ED5 Mosaic.
- Three new sections of treeline (to the south of the capped landfill, between the capped landfill and landfill gas facility). These treelines are of recent origin (planted after construction of the original landfill cells), formed by ash *Fraxinus excelsior* and Leyland cypress *Cupressus × leylandii* trees.
- A new hedgerow of cherry laurel *Prunus laurocerasus* has been planted to the north of the landfill office.
- Man-made drainage channel running through the block of plantation woodland in the north-eastern corner of the consented landfill and from the existing wetland towards the Flemingstown 08 Stream.

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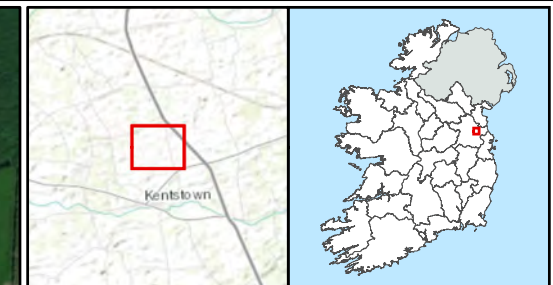


- Planning Boundary
- Habitat**
- FW1 - eroding river
- FW4 - drainage ditches
- WL1 - hedgerow
- WL2 - treeline
- BL3 - buildings and artificial surfaces
- ED2 - spoil and bare ground
- ED2 / ED3 - spoil and bare ground / recolonising bare ground mosaic
- ED3 - recolonising bare ground
- FL8 - artificial lakes and ponds
- FS1 - reed and large sedge swamps
- GA1 - improved agricultural grassland
- GA1 / GS4 - improved agricultural grassland / wet grassland mosaic
- GA2 - Amenity
- GA2/GS2/ED5 - amenity grassland / dry meadows and grassy verges / refuse and other waste
- GS2 - dry meadows and grassy verges
- GS4 - wet grassland
- GS4 / GS2 - wet grassland / dry meadows and grassy verges mosaic
- WD1 - (mixed) broadleaved woodland
- WD1 / GS4 - (mixed) broadleaved woodland / wet grassland mosaic
- WD2 - mixed broadleaved / conifer woodland
- WD4 - Conifer Plantation
- WS1 - scrub
- WS1 / WD2 - scrub / mixed broadleaved-conifer woodland mosaic
- WS3 / WS1 - ornamental/non-native shrub / scrub mosaic

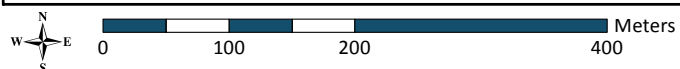
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|--------------------|---------------------------------|
| TITLE: | Habitats |
| PROJECT: | Knockharley Landfill, Co. Meath |
| FIGURE NO.: | 1 |
| CLIENT: | Knockharley Landfill Ltd. |
| SCALE: | 1:6000 |
| REVISION: | 0 |
| DATE: | 21/10/2019 |
| PAGE SIZE: | A3 |





- Botanical Survey Plot Locations
- Planning Boundary



| | | | |
|-------------------|---------------------------------|--|----|
| TITLE: | Botanical Survey Plot Locations | | |
| PROJECT: | Knockharley Landfill, Co. Meath | | |
| FIGURE NO: | 2 | | |
| CLIENT: | Knockharley Landfill Ltd. | | |
| SCALE: | 1:6000 | REVISION: | 0 |
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| | | Cork Dublin Carlow www.fehilytimoney.ie | |

4.2 Updated Habitat Descriptions

Wet Grassland/Dry Meadows and Grassy Verges (GS4/GS2) Mosaic

A mosaic of these habitat types is present in the fields to the east of the capped portion of the existing landfill (within the footprint of the proposed biological treatment facility), bordering agricultural grassland close to the east of the existing landfill offices (within the footprint of the proposed berm surrounding the proposed incinerator bottom ash facility), in the northernmost field within the permitted extension footprint and at the northwest corner of the consented landfill.

These fields are variable in character, containing short, sparse vegetation in drier areas, and tall dense swards in wetter areas. These broad assemblages form mosaics, grading into one another. The dominant grasses are Yorkshire fog *Holcus lanatus*, common couch *Elymus repens* and timothy *Phleum pratense*, the latter forming dense swards on occasion. Hard rush *Juncus acutus* is co-dominant in parts. Soft rush *J. effusus* and sharp-flowered rush *Juncus acutiflorus* are also present. Creeping and common bent-grass *Agrostis stolonifera* and *A. capillaris* are common, with sweet vernal-grass *Anthoxanthum odoratum* dominating patches locally. Reed canary-grass *Phalaris arundinaceae* is present in one area. Other grasses include rough meadow-grass *Poa trivialis*, false oat-grass *Arrhenatherum elatius*, cock's foot *Dactylis glomerata* and red fescue *Festuca rubra*. The latter is more common in drier areas, forming a finer sward.

An array of common herbs are present, ranging from red and white clovers *Trifolium pratense*, *T. repens*, creeping cinquefoil *Potentilla reptans*, cut-leaved cranesbill *Geranium dissectum*, greater birds-foot trefoil *Lotus pedunculatus*, oxeye daisy *Leucanthemum vulgare* and black medick *Medicago lupulina* in drier parts to more widely distributed species such as dandelion *Taraxacum officinale*, creeping thistle *Cirsium arvense*, meadow and creeping buttercup *Ranunculus acris*, *R. repens*, bush vetch *Vicia sepium*, silverweed *Potentilla anserina*, lesser stitchwort *Stellaria graminea*, great willowherb *Epilobium hirsutum*, meadow vetchling *Lathyrus pratensis*, nettle *Urtica dioica*, cleavers *Galium aparine*, common ragwort *Jacobaea vulgaris*, tufted vetch *Vicia cracca*, and broad-leaved and curled docks, *Rumex obtusifolius*, *R. crispus*, and marsh thistle *C. palustre* and spear thistle *C. vulgare*.

Knapweed *Centaurea nigra* is common in the field to the north of the existing landfill (within the consented landfill footprint) but is not present in the footprint of proposed infrastructure. Field horsetail *Equisetum arvense* is present occasionally and meadow sweet *Filipendula ulmaria* was recorded only once.

Sedges are also present, black sedge *Carex nigra* in pockets in drier areas, glaucous sedge *C. flacca* and star sedge *C. echinata* were also recorded. Hairy sedge *C. hirta* and oval sedge *C. leporina* were both recorded amongst dense grassy swards. An unusual record was a single specimen of heath woodrush *Luzula multiflora* subsp. *Congesta*, found growing in a dense sward of grasses and rushes (see Q2 in Appendix 3).

Only one moss species is present (occasionally) in association with this habitat; pointed spear-moss *Calliergonella cuspidata*, a common component of grassland habitats.

While the species present represent a more semi-natural habitat than that recorded during previous surveys, this can be accounted for by the continuation of successional processes which commenced with bare soil and/or previously intensively managed agricultural land subsequent to landfill construction.

While the lack of intensive grassland management has allowed grassland areas to become more natural in character, their recent establishment and history of disturbance on the site associated with landfill cell construction means these areas are not highly valuable in ecological terms, and do not correspond to any Annex 1 grassland habitats. These grasslands are of *Local importance (higher value)*.

Quadrats and one Relevé (Q 1-6, R2) were recorded in this habitat type and these are detailed in Appendix 3, accompanied by photographs. See Figure 2 above for quadrat and relevé locations.

Comparison of the species list recorded for this mosaic within the footprint of the proposed development species lists for the corresponding Annex 1 habitats- [6510] Lowland Hay Meadows and [6410] *Molinia* Meadows was carried out.

The comparison identified a small (sub-threshold) portion of these species are present, with 6 typical species including 1 high quality species for [6510] Lowland Hay Meadows and 6 typical species for [6410] *Molinia* Meadows (See Appendix 1 for details of the comparison).

Analysis of the plots recorded in this mosaic using ERICA classified the semi-natural vegetation in the fields within the proposed development as the communities GL4A *Agrostis capillaris* - *Trifolium repens*, GL2B *Juncus effusus* - *Holcus lanatus* (assigned), GL2C *Holcus lanatus* - *Lolium perenne*, SM4A *Festuca rubra* - *Agrostis stolonifera*, GL2A *Agrostis stolonifera* - *Ranunculus repens* and *Holcus lanatus* - *Lolium perenne* (transitional) (see Appendix 2 for details).

None of these correspond to the IVC grassland communities within which [6510] Lowland Hay Meadows and [6410] *Molinia* Meadows can be classified (GL3E *Festuca rubra* - *Rhinanthus minor* and GL1C *Molinia caerulea* - *Succisa pratensis*) (see Appendix 1 for details).

[6510] Lowland Hay Meadows is also described as being rich in flowers in the EU Habitats Manual (EC, 2013). The grasslands on site are not rich in flowers.

As such this habitat mosaic does not correspond to the Annex I habitat types.



Plate 8: Wet Grassland/Dry Meadows and Grassy Verges GS4/GS2 Mosaic (east of existing landfill)

Dry Meadows and Grassy Verges GS2

Areas of this habitat type are present within the footprint of the proposed leachate lagoons, the footprint of the proposed extension to the leachate management facility, and to the north of the existing site office. These areas contain a portion of the species present in the GS4/GS2 mosaic described above, but are generally drier, more uniform and have a finer and lower sward. The dominant species are Yorkshire fog and red clover and the lack of rushes contrasts sharply with the GS4/GS2 mosaic found in other areas. Other species present include hop trefoil *Trifolium campestre*, meadow buttercup, dandelion, common bent-grass, timothy-grass, sweet vernal-grass, ragwort, ribwort plantain *Plantago lanceolata*, common sorrel *Rumex acetosa*, lesser stitchwort, tufted and bush vetch.

The finer sward and uniformity are judged to be due to thinner drier soils, with past management and disturbance also potentially contributing. The uniformity observed suggests the area was previously covered by Improved Agricultural Grassland (GA1), which has been allowed to revert to a more natural state.

While more natural in character than intensively managed pasture or amenity grassland, the areas of this habitat within the proposed development footprint are of recent origin and not particularly species-rich. This habitat is considered to be of *Local importance (higher value)*.

One Relevé (R1) was recorded in this habitat type. This is detailed in Appendix 3 accompanied by photographs. See Figure 2 for Relevé location. Comparison of the species list recorded for this habitat within the footprint of proposed development with species lists for the corresponding Annex 1 habitat [6510] Lowland Hay Meadows was carried out. The comparison identified a small (sub-threshold) portion of these are present, with four typical species and no high-quality species for this habitat type present (See Appendix 1 for details of the comparison).

Analysis of the plot recorded in this habitat using ERICA classified the semi-natural vegetation in the fields within proposed development as the community GL2C *Holcus lanatus* - *Lolium perenne* (assigned) (see Appendix 2).

GL2C does not correspond to the IVC grassland community within which [6510] Lowland Hay Meadows can be classified (GL3E *Festuca rubra* – *Rhinanthus minor*) (see Appendix 1 for details).

[6510] Lowland Hay Meadows is also described as being rich in flowers in the EU Habitats Manual (EC, 2013). The grasslands on site are not rich in flowers.



Plate 9: Dry Meadows and Grassy Verges GS2 (east of existing landfill)

Wet Grassland GS4

An area of wet grassland is present to the south of the existing landfill gas compound and surrounding the existing surface water attenuation pond and wetland. The vegetation is similar to that described above, with Yorkshire fog, sweet vernal-grass, marsh thistle, tormentil *Potentilla erecta*, soft and hard rush recorded in this area.

This habitat type is not within the footprint of any proposed infrastructure. It is of *Local importance (higher value)*. The low species diversity and presence of only 1 characteristic species (*P. erecta*) from the corresponding Annex 1 habitat [6410] *Molinia* Meadows indicates this area has no links with Annex 1.

Improved Agricultural Grassland GA1

This habitat type is present within the footprint of the proposed incinerator bottom ash (IBA) facility and associated proposed berm to the east, and also in areas along the northern and eastern edges of the site. Yorkshire fog and perennial rye-grass *Lolium perenne* are the dominant grasses, with one or the other of these species being dominant in individual fields. Limited amounts of fescue *Festuca* sp. are present. Forbs represent only a small proportion of the vegetation, the most abundant of these were creeping and meadow buttercup, while dandelion, white clover, lesser chickweed *Stellaria pallida*, thistle seedlings, spear thistle, curled and broad-leaved dock, along with common mouse-ear *Cerastium fontanum* were also present. Capillary thread-moss *Bryum capillare* is present in some areas where soil is exposed. No other bryophytes are present in this habitat type.

The fields within the proposed IBA facility footprint had been recently reseeded and spread with slurry. These intensively managed grasslands are of limited ecological value and are classified as *Locally important (lower value)*.

Quadrats (Q 7-10) were recorded in this habitat type (in fields within the proposed IBA facility footprint). These are detailed in Appendix 3 accompanied by photographs. See Figure 2 for relevé locations. Due to the low biodiversity value and intensive management of this habitat, detailed analysis was not carried out.



Plate 10: Improved Agricultural Grassland GA1 (north-east of existing landfill)

Amenity Grassland GA2

Short, regularly mowed grasslands are present at the landfill office, and a house along the northern landfill boundary. Species diversity is low, with dandelion, white clover and ribwort plantain being common forbs.

Amenity grassland surrounding the existing landfill site office is within the footprint of proposed carpark extension. This type of intensively managed grassland is of limited ecological value and is therefore classified as *Locally important (lower value)*.

Amenity Grassland/Dry Meadows and Grassy Verges/Refuse and Other Waste GA2/GS2/ED5 Mosaic

This habitat mosaic is represented on the capped re-vegetated landfill. The capped landfill supports a grassland community dominated by Yorkshire fog, false oat-grass and red clover and colt's foot *Tussilago farfara*, particularly along the marginal areas.

This habitat is not within the footprint of the proposed development. It is of *Local importance (higher value)* due to its semi-natural character and low intensity management.

(Mixed) Broadleaved Woodland WD1

The areas of mixed broadleaved woodland within the site are all plantations of recent origin and uniform age, as described in Section 1.1 above. Aerial imagery indicates these plantations were established between 2005-2012. Two of these blocks are within the footprint of the proposed IBA facility, proposed surface water holding pond, proposed northern attenuation lagoon, proposed screening berm and a consented landfill cells (phase 7) all of which are located in close proximity to each other. Another separate block of planted woodland is within the footprint of another proposed screening berm.

The dominant tree species are ash, alder *Alnus glutinosa* and sycamore *Acer pseudoplatanus*, which have been planted in rows and are of uniform age and size, with an average diameter at breast height (DBH) of c. 30 cm and height of c. 8 m. A shrub layer is absent in most areas, and where present is represented by bramble thickets. The field layer is dominated by grasses, with smooth meadow-grass *Poa pratensis*, false oat-grass, Yorkshire fog and bent-grasses being common along with sheep's fescue which is present occasionally. Some soft rush is also present in wetter sections. The only sedge recorded was remote sedge *Carex remota*, a species commonly associated with woodlands, which is present in limited quantity.

The canopy is markedly more open in parts of the middle block (where the proposed wetland is located) where the trees have not established well. As such, while partially wooded, grassy clearings with stunted trees and large canopy gaps are also present. A dense sward dominated by Yorkshire fog and common bent-grass makes up the field layer in these areas (see WR3 in Appendix 4).

The broadleaved herbs present- cleavers, creeping buttercup, rosebay willowherb, short-fruited willowherb *Epilobium obscurum* great willowherb, dandelion and creeping cinquefoil are common species more often found in open habitats or across habitats, with no woodland specialist forbs present. Single occurrences of short-fruited willowherb *Epilobium obscurum* and wavy bitter-cress *Cardamine flexuosa* were recorded.

Four common mosses associated with woodland, and neutral to basic soils were identified. There are fox-tail feather-moss *Thamnobryum alopecurum*, common feather-moss *Kindbergia praelonga*, mouse-tail moss *Isoetecium myosuroides* and short-leaved/lesser pocket-moss *Fissidens incurvus/bryoides* are fairly evenly distributed throughout this habitat type within this area of the site. Distinction between *F.incurvus/bryoides* requires the presence of capsules, which were absent during the survey. Distribution maps indicate this is more likely to be *F. bryoides*, however this is not sufficient basis for positive identification².

The rarer slender pocket-moss *Fissidens exilis* cannot be mistaken for either of these species, as it forms thin patches and has shoots 1.5-3mm long with 2-4 pairs of leaves which lack borders. *F. incurvus* and *F. bryoides* have shoots from 2-20mm long with leaves, bordered leaves and form distinct cushions.

Up to 9 pairs of leaves on shoots from 3-9mm were present on *F.incurvus/bryoides* specimens collected from this habitat at Knockharley.

² *F. incurvus* and *F. bryoides* are both medium-sized *Fissidens* with bordered leaves. While the longer shoot length (max. 9mm) indicates *F. bryoides*, the lack of bud-like male organs indicates *F. incurvus*. *F. incurvus* grows on calcareous to slightly acidic soil, while *F. bryoides* grows on neutral to slightly acidic soil, both in woodlands; as such the habitat is suitable for either species. Therefore, capsules (inclined in *F. incurvus*, erect in *F. bryoides*) are required to differentiate between the two species; none were present during surveys.

Dead wood is made up primarily of occasional twigs scattered on the ground and one standing dead tree of similar size to those surrounding (20 cm DBH) was recorded. No fallen trees or large logs are present. Natural regeneration is most evident in ash-dominated areas, where numerous seedlings of the same species are present. Two pedunculate oak *Quercus robur* saplings and one larger (4m) immature tree are present near Woodland Relevé 1 (WR1) (see Figure 2). A mature pedunculate oak in the nearby hedgerow along the eastern boundary of the plantation is likely to be the parent of these trees, while the location of the younger trees inside the plantation block indicates transport by animals such as squirrels *Sciurus* Sp. or potentially Eurasian jay *Garrulus glandarius*.

No lichens are present in these plantations.

Hedgerows are present fringing and running between plantation blocks, marking field boundaries present before woodland was planted in these areas.

These mixed broadleaved woodlands are considered to be of *Local importance (higher value)*. While of some value to local wildlife, their recent establishment and lack of mature woodlands nearby mean they are artificial in character and of relatively low biodiversity value in comparison with established woodlands.

Relevés (WR1 and WR4) were recorded in this habitat type, see Appendix 4 and Figures 1 and 2 for details.

Detailed analysis of vegetation was not undertaken as the physical characteristics, uniform age of trees and information on site history confirm these woodlands are of recent and artificial origin. It is also noted that these woodlands were not intended to remain within the site in perpetuity. They are currently subject to ongoing forestry management practices including thinning and are intended to be felled once they reach harvestable size or during the course of facility development.



Plate 11: Mixed Broadleaved Woodland WD1 Plantation (north-east of existing landfill)

(Mixed) Broadleaved Woodland/Wet Grassland WD1/GS4 Mosaic

This habitat mosaic is present to the east of the existing landfill gas compound and adjacent to the proposed biological treatment facility. While trees were planted on a screening berm, the entire area was not covered (isolated islands of trees were planted), and the open areas are being recolonised by alder and grasses.

This mosaic is not within the footprint of any permitted or proposed development and is considered to be of *Local importance (higher value)*.

Mixed Broadleaved/Conifer Woodland WD2

Mixed plantations with alternating rows of scot's pine and pedunculate oak form the dominant habitat along the northern and western site boundaries and are present in more limited amounts along the southern and eastern boundaries. A dense canopy results in heavy shading, and the woodland floor being made up of bare soil, leaf litter and needles in most areas. Where light occasionally enters, sparse patches of Yorkshire fog and *Poa* Sp. are present. Ivy *hedera helix* and rosebay willow herb grow sparsely near the edges. Other plants present include bramble, nettle and herb-robert *Geranium robertianum* which form stands where light is available.

A fringing area of the mixed broadleaved woodland plantation abutting the proposed biological treatment facility is made up of recently established naturally regenerating willow and alder woodland, with wide low (4-5m width & height) willow bushes and young alder trees (4-5m, DBH c. 25cm), with a bramble-dominated field layer. This area is within the footprint of the proposed biological treatment facility and associated clearance/levelling works.

A number of Mixed Broadleaved/Conifer Woodland blocks along the western site boundary are within the footprint of a proposed screening berm. Fox-tail feather-moss *Phymobryum alopecurum*, common feather-moss *Kindbergia praelonga* and mouse-tail moss *Isoetes myosuroides* are present on occasion on the woodland floor and tree bases.

Other trees are also present including birch, alder, willow, sycamore, ash and lodgepole pine.

This habitat is considered to be of *Local importance (higher value)*.



Plate 12: Mixed Broadleaved/Conifer Woodland WD2 (along north and western boundaries of landfill site)

Mixed Broadleaved/Conifer Woodland/Scrub WD2/WS1 Mosaic

A mosaic of these habitats is present to the south and west of the surface water attenuation pond and wetland. Common elements include trees such as alder and lodgepole pine, with growths of gorse and bramble as described in detail for these habitats above. This area is not within the footprint of any permitted or proposed development.

Due to its semi-natural character this habitat is considered to be of *Local importance (higher value)*.

Conifer Plantation WD4

Conifer plantations made up of lodgepole pine *Pinus contortus* are present to the north of the main access road. These are characterised by rows of trees planted in close proximity, forming a dense thicket with heavy shading and limited plant growth on the woodland floor, similar to that described above for *Mixed Broadleaved/Conifer Woodland WD2*.

These blocks are within the footprint of the proposed screening berm to the east of the proposed IBA facility. This habitat is considered to be of *Local importance (Lower value)*.

Buildings and Artificial Surfaces BL3

This habitat type is represented by roads, buildings including sheds and landfill office, and landfill infrastructure such as the leachate lagoon and landfill gas compound. The biodiversity value, if any, of these habitats is detailed in the bird and bat survey reports for the site.

Spoil and Bare Ground ED2

Extensive areas of exposed soil and gravel are present to the north and west of the existing landfill, made up of under-construction permitted cells, and associated spoil mounds. These areas are of limited biodiversity value in their current form.

Recolonising Bare Ground ED3

An area of recolonising bare ground is present to the south of the capped landfill, formed by a berm running along the southern side of the access road running around the landfill. Vegetation is dominated by coltsfoot *Tussilago farfara*, with some dock *Rumex* Sp. present on occasion.

The non-native invasive species Himalayan balsam *Impatiens glandulifera* is present in the western end of this area i.e. at the southwestern corner of the rectangle formed by the access road running around the capped landfill. This is not within the footprint of any proposed infrastructure. Himalayan balsam is listed on Schedule III under Regulations 49 and 50 of the EC (Birds & Natural Habitats) Regulations.

Spoil and Bare Ground/Recolonising Bare Ground ED2/ED3 Mosaic

Areas fringing the east and northwest of the consented landfill cells contain this habitat mosaic. In level areas, the ground is being re-colonised by common and ruderal species including coltsfoot *Tussilago farfara*, marsh thistle, goat willow *Salix caprea*, creeping buttercup, American willowherb *Epilobium ciliatum*, white clover, rough hawkbit *Lentodon hispidus*, perennial sow-thistle *Sonchus arvensis*, Yorkshire fog, pointed spear-moss and common ragwort, but vegetation cover is less than 50%.

The recolonising element of the mosaic is represented by densely vegetated spoil heaps and berms, the latter being covered in dense growths of spear thistle, and spoil heaps hosting a higher number of species, with false oat-grass dominating, and curled dock, bush vetch, spear thistle, dandelion, creeping buttercup, common ragwort, creeping cinquefoil, great and rosebay willowherbs also present.

This habitat mosaic resulted from clearance and earthworks associated with ongoing construction of consented landfill cells.

This habitat type is within the proposed IBA facility footprint. It is a transitory and severely disturbed habitat of limited ecological value and it is classified as *Locally important (lower value)*.



Plate 13: Spoil and Bare Ground/Recolonising Bare Ground ED2/ED3 Mosaic (within proposed IBA facility footprint)

Scrub WS1

Areas of scrub border the existing landfill to the west and south. Extensive patches of bramble are present, with occasional common gorse *Ulex europaeus* bushes and lone trees (ash, alder, willow *Salix* Sp.,) interspersed throughout. Grassy vegetation dominated timothy-grass is present in open areas. This habitat type is not within the footprint of any proposed or permitted development.

This habitat is considered to be of *Local importance (higher value)*.

Ornamental/Non-native Shrub/Scrub WS3/WS1 Mosaic

Wide (to 6-7m) hedges dominated by non-native dogwood *Cornus* Sp. and interspersed with occasional sycamore and willow trees, and areas of grassy vegetation and bramble thickets line the main site access road along the straight section approaching the landfill offices.

This mosaic is present within the footprint of the proposed screening berm surrounding the proposed IBA facility, and within the proposed screening berm to the south of the main landfill access road.

This habitat is considered to be of *Local importance (higher value)* due to the presence of scrub.

Hedgerows WL1

Hedgerows are present throughout the site, delineating field boundaries and bordering trackways. Hedgerows are also present bordering and sandwiched between blocks of planted woodland.

Hedgerows are dominated by mature ash and hawthorn *Crataegus monogyna* trees, with pedunculate oak *Quercus rubra*, hazel *Corylus avellana*, willows *Salix* spp. and sycamore *Acer pseudoplatanus* also present on occasion; bramble *Rubus fruticosus* Agg. and common gorse *Ulex europaeus* form a thicket underneath. Ivy *Hedera helix* is common on tree crowns.

Other species present include guelder rose *Viburnum opulus*, soft shield fern *Polystichum setiferum*, hart's tongue fern *Asplenium scolopendrium*, dog rose *Rosa canina*, and field horsetail. A section of hedgerow made up of cherry laurel *Prunus laurocerasus* is present around the landfill office.

Moderate quality ash and hawthorn-dominated hedgerows are present in the footprint of the proposed leachate management facility and biological treatment facility.

A lack of connectivity reduces the importance of these hedgerows as wildlife corridors. Good-quality ash-dominated hedgerows are present within the footprint of the proposed IBA facility and associated proposed screening berm.

Hedgerows are considered to be of *Local importance (higher value)* as they are semi-natural habitats, providing foraging grounds, shelter and connectivity in the landscape for wildlife.



Plate 14: Hedgerows WL1 (within proposed leachate lagoon footprint)

Treelines WL2

A number of treelines are present within and bounding the site. Good-quality established ash-dominated treelines with occasional pedunculate oak are present within the footprint of the proposed IBA facility and associated proposed screening berm.

Outside the proposed development footprint, treelines associated with field boundaries are present in the east and west of the site, while uniform Leyland cypress *Cupressus × leylandii* and ash treelines planted for screening run along the eastern edge of the capped landfill and southern site boundary.

Treelines are considered to be of *Local importance (higher value)*.

Artificial Lakes and Ponds FL8

This habitat is represented within the site by the surface water attenuation pond and constructed wetland immediately to the south. The attenuation pond is highly artificial in character, being lined with artificial liner and having regular banks which are devoid of aquatic vegetation.

The constructed wetland immediately to the south is more natural in character, supporting reedbeds dominated by common reed *Phragmites australis*, with some bulrush *Typha latifolia* also present.

An invertebrate sample was also collected from the wetland, with low-moderate species richness recorded (9 common invertebrate species typical of pond environments including gastropods, damselfly larvae and pond olives were recorded). Three-spined stickleback *Gasterosteus aculeatus* were also present.

An adult Kingfisher was observed in flight heading upstream along the Flemingstown 08 (Knockharley) Stream near the landfill boundary, towards the existing wetland³.

The wetland is at a lower elevation to the south and is connected to the surface water attenuation pond via an overflow channel/spillway. There is connectivity between the wetland and surrounding stream network, with the outflow joining the Flemingstown 08 stream. This was observed to be dry during surveys, indicating that a hydrological connection exists only during wetter periods.

The surface waste attenuation pond is considered to be of limited ecological value, while the associated wetland to the south is considered to be of *Local importance (higher value)* due to the presence of reedbeds and potential for connectivity with the stream network. This habitat type is not within the footprint of any proposed development.

Reed and Large Sedge Swamps FS1

This habitat is present in association with the wetland to the south of the surface water attenuation pond, as described in *Artificial Lakes and Ponds FL8* above. Although artificial in origin, this area has developed characteristics similar to natural wetlands.

As such it is considered to be of *Local importance (higher value)*. This habitat type is not within the footprint of any proposed development.

Eroding Rivers FW1

The Flemingstown 08 (Knockharley) stream flows through the site on a number of occasions, and also skirts its boundary in a number of locations. The Kentstown 08 stream flows along a short length (c. 90m) of the landfill boundary at its southwestern tip. The Flemingstown 08 stream is in poor condition due to human interference; the channel has been straightened, deepened and dredged, resulting in a watercourse with little natural character, more akin to a drainage ditch. Water levels were observed to fluctuate markedly during summer 2019 with extremely low levels during dry periods and higher volumes on occasion following wet periods. The bankside vegetation generally lacks a distinctive riparian character, being made up predominantly of the grassy vegetation which dominates much of the site; great willowherb is common along the banks. In other areas the stream flows through blocks of forestry plantation. The only characteristic vegetation present were marginal growths of water mint *Mentha aquatica* and some filamentous algae *Cladophora* spp.

Kick sampling and subsequent analysis indicated poor water quality Q2-Q3 both up and downstream of the landfill site, due to pressures from agriculture. Three-spined stickleback *Gasterosteus aculeatus* was the only fish species recorded during electrofishing surveys (recorded downstream of the landfill site).⁴

The Flemingstown 08 stream is within the footprint of consented landfill footprint to the north of the existing operational landfill cells, and diversion of the stream in this area is permitted under ABP Reference PL17.220331. Following the diversion, the stream intersects with the footprint of a proposed screening berm, and a culvert is proposed to be installed at this location. The stream diversion runs adjacent to the proposed wetland, which discharges treated surface water to the stream.

While this habitat is automatically classified as *Local importance (higher value)* due to it being an officially mapped stream by the EPA, its current poor condition means that it is in fact of lower ecological value than a similar habitat in a more natural state. However, it forms a hydrological connection to larger watercourses downstream of the landfill site.

³ ³ Additional data on water quality, aquatic habitats and fauna was obtained from the Aquatic baseline report.

⁴ ⁴ Additional data on water quality, aquatic habitats and fauna was obtained from the Aquatic baseline report.

Drainage Ditches FW4

Drainage ditches are present in a number of areas, including within blocks of broadleaved plantation and immediately south of the capped landfill. The ditches to the south of the landfill were dry when observed, and lacking aquatic vegetation. Great willowherb, ragwort and docks grow in these ditches, and gorse is present on the banks.

The drainage channel separating two blocks of broadleaved woodland in the northwest of the site contains water and is more densely vegetated, with wet grassland vegetation dominated by Yorkshire fog and meadowsweet. Other species noted included goat willow, bulrush, duckweed *Lemna* Sp. and wild angelica *Angelica sylvestris* present within and fringing the channel.

The wetter drainage channel is considered to be *Local importance (higher value)* having developed semi-natural characteristics in the absence of management. This channel is within the footprint of the proposed surface water holding pond, proposed northern attenuation lagoon, proposed screening berm and consented landfill cells (phase 7).

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5 IMPACTS ON HABITATS AND FLORA

The description of development is presented in Chapter 2 of the EIAR: Description of the Proposed Development.

The proposed site layout is shown in Drawing No.'s LW14-821-01-P-0000-003 through 011 (Proposed Site Layout Plan). The cut/fill phasing plan is shown on Drawing No. LW14-821-01-P-0050-011. These drawings are presented in Volume 4 of the EIAR.

As presented in the EIAR, the construction of these elements requires the felling of plantation woodlands, when constructed, the proposed berms will be planted with trees and both restorative (replanted in previous location) and new planting will be carried out. Restorative planting and a portion of the new planting are considered as compensatory in addition to providing screening. The remainder of new planting is for screening purposes. The felling and re-planting plan is shown on drawing LW14-821-01-P-0050-003. A mix of broadleaved and coniferous forestry re-planting is proposed.

A habitat loss figure distinguishing between consented and proposed development is included below (Figure 3). Table 3 provides an evaluation of each habitat type, determining which are key receptors based on ecological value and location in relation to proposed development footprints, and also includes a defined area or length where habitats are lost within the footprint of proposed infrastructure. Those selected as key receptors are given further consideration in 4.3 Habitats and Flora.

The construction of the IBA facility and associated berm will result in the loss of 4.8 ha of Improved Agricultural Grassland GA1, while 2.3 ha of Spoil and Bare Ground/Recolonising Bare Ground ED2/ED3 Mosaic, 1.3 ha of Spoil and Bare Ground ED2 and 0.09 ha of Amenity Grassland GA2 will be lost within the footprint of the IBA facility. Since none of these habitats are key ecological receptors due to their limited biodiversity value and transient nature, they are not considered further in this assessment.

A total of 1,059m of Hedgerows WL1 and 543m of Tree Lines WL2 will be lost within the footprint of proposed development. Drainage Ditches FW4 totalling 129m in length will also be lost within the proposed development footprint. These semi-natural habitats are classified as Local Importance (higher value) and as such are key ecological receptors.

A section of Eroding Rivers FW1 31m in length lies within the footprint of the proposed eastern screening berm. This section of river will be culverted and as such altered, but not lost completely. Eroding Rivers FW1 is a key ecological receptor.

Table 3: Habitat Evaluation and Loss Table (Proposed Development Footprint)

| Habitat | Evaluation | Area Lost (ha) | Rationale | Selection as key ecological receptor |
|--|---------------------------------|----------------|--|--------------------------------------|
| Improved Agricultural Grassland GA1 | Local Importance (lower value) | 4.8 | Intensively managed grassland – low biodiversity value | No |
| Wet Grassland/Dry Meadows and Grassy Verges GS4/GS2 Mosaic | Local Importance (higher value) | 2.8 | Semi-natural habitat in proposed footprint | Yes |
| Dry Meadows and Grassy Verges GS2 | Local Importance (higher value) | 2.1 | Semi-natural habitat in proposed footprint | Yes |
| Wet Grassland GS4 | Local Importance (higher value) | 0 | Semi-natural habitat but outside proposed footprint | No |

| Habitat | Evaluation | Area Lost (ha) | Rationale | Selection as key ecological receptor |
|---|---------------------------------|----------------|---|--------------------------------------|
| (Mixed) Broadleaved woodland WD1 | Local Importance (higher value) | 3.6 | Semi-natural habitat in proposed footprint | Yes |
| Conifer Plantation WD4 | Local Importance (higher value) | 0.6 | Of value to local wildlife | Yes |
| Mixed Broadleaved/Conifer Woodland WD2 | Local Importance (higher value) | 7.2 | Semi-natural habitat in proposed footprint | Yes |
| Buildings and Artificial Surfaces BL3 | Local Importance (lower value) | 0.5 | Not in proposed footprint | No |
| Spoil and Bare Ground ED2 | Local Importance (lower value) | 1.3 | Limited biodiversity value; not in proposed footprint | No |
| Recolonising Bare Ground ED3 | Local Importance (lower value) | 0 | Limited biodiversity value; not in proposed footprint | No |
| Spoil and Bare Ground/Recolonising Bare Ground ED2/ED3 Mosaic | Local Importance (lower value) | 2.3 | Limited biodiversity value | No |
| Scrub WS1 | Local Importance (higher value) | 0 | Not in proposed footprint | No |
| Amenity Grassland GA2 | Local Importance (lower value) | 0.09 | Limited biodiversity value | No |
| Ornamental/Non-native Shrub/Scrub WS3/WS1 Mosaic | Local Importance (higher value) | 0.2 | Semi-natural elements; in proposed footprint | Yes |
| Artificial Lakes and Ponds FL8 | Local Importance (lower value) | 0 | Artificial character; not in proposed footprint | No |
| Reed and Large Sedge Swamps FS1 | Local Importance (higher value) | 0 | Semi-natural habitat but not in proposed footprint | No |

5.1 Habitats and Flora

In the following section the impacts on terrestrial habitats as determined in the EIAR are included verbatim (with grey background and original numbering) where any changes, additions or notes arising from the current assessment based on additional data occur. Additional information is included in bold below the relevant paragraph.

5.1.1 Construction Phase Impacts

10.5 Potential Impacts of the Proposed Development on Ecology

10.5.2.2 Habitats and Flora

The construction phase of the development is broken into four phases; construction year 0,1 & 2, construction year 3 & 4, construction year 5 & 6 and construction year 7 & 8 and includes the creation of berms (presented in Drawing Nos. LW14-821-01-P-0050-011). In terms of habitats, the construction of the IBA facility, biological treatment, surface water pond and berm creation will result in a loss of agricultural grassland (GA1/GS4), wet grassland (GS4), mixed broadleaved/coniferous woodland (WD2) and deciduous woodland (WD1) and section of hedgerow (WL1) and treeline (WL2).

The removal of hedgerow (WL1) and treeline (WL2) will be limited. These habitats provide cover and foraging habitat to local wildlife. Prior to mitigation the loss of these habitats will have a **Permanent Moderate Impact**.

Sections of Hedgerows WL1 totalling 1,059 m in length will be lost within the footprint of the proposed IBA Facility and associated screening berm. These habitats provide cover and foraging habitat to local wildlife. The loss of these habitats will have a Permanent-Moderate Impact.

Sections of Treelines WL2 totalling 543 m in length will be lost within the footprint of the proposed IBA Facility and associated screening berm. Similar to hedgerows, these habitats provide cover and foraging habitat to local wildlife; the loss of these habitats will have a Permanent-Moderate Impact.

The proposed extension to leachate management facility will result in the loss of improved agricultural grassland/wet grassland mosaic (GA1/GS4). Improved agricultural grassland/wet grassland mosaic (GA1/GS4) is of Local Importance (lower value) and its loss will have a **Permanent Slight Impact**.

Construction of the proposed biological treatment facility will result in the loss of wet grassland (GS4) which provides cover and foraging habitat for local wildlife and is of Local Importance (Higher Value). Wet grassland (GS4) on site is limited in area and will result in a **Permanent Slight Impact**.

While these areas have been re-classified in terms of habitats, the current impact assessments for semi-natural grasslands are included here for continuity. The assessments refer to the same areas and infrastructure assessed in the EIAR.

Dry Meadows and Grassy Verges GS2 totalling 2.1 ha will be lost within the footprint of the proposed additional leachate lagoons, extension to the leachate management facility, and IBA facility. While beginning to take on a more semi-natural character, this area is still relatively species-poor and monotypic. The loss of this will have a Permanent-Slight Impact.

The construction of the proposed biological treatment facility will result in the loss of 2.8 ha of Wet Grassland/Dry Meadows and Grassy Verges GS4/GS2 Mosaic. While not particularly unique among rougher less intensively-managed grasslands, this habitat provides cover and foraging habitat for local wildlife, and more habitat for insects than intensively-managed pasture or cropland. The loss of these areas will have a Permanent-Moderate Impact.

Broadleaved/coniferous woodland (WD2) and deciduous woodland (WD1) has been planted on site for commercial timber production and will be felled when trees reach maturity or felled to facilitate the phased development of the site. Felling of areas of broadleaved/coniferous woodland (WD2) and deciduous woodland (WD1) will be undertaken over the phased 8 year construction phase (see Drawing No. LW14-821-01-P-0050-003, Table 10-16 below and Chapter 2 Proposed development for more information). Most tree felling will occur in the first phase; 7.5ha of deciduous woodland (WD1) will be felled, with no broadleaved/coniferous woodland (WD2) felled. During the following phases (years 3-8) 5ha of broadleaved/coniferous woodland (WD2) will be felled with no deciduous woodland (WD1) felled. During the construction phase a total of 12.5ha of trees will be felled; this accounts for 78.98% of woodland on site.

While woodland will be felled during the construction phase, 14.1ha of woodland will be restored and 29.3ha of native deciduous tree compensation planting will be undertaken as part of the proposed development (presented in Drawing Nos. LW14-821-01-P-0050-003).

With replanting taking into account, as well as the phased manner in which felling will take place, and the young age of the forestry, the impact on broadleaved/coniferous woodland (WD2) and deciduous woodland (WD1) is deemed to be a **Short-Term Moderate Impact**. As woodland on site is for commercial timber production, felling and replanting will occur whether the proposed development goes ahead or not.

[Table 10-16: Phased felling during construction phase]

| Phase | Ha | % Deciduous woodland plantation (WD1) | % Broadleaved/coniferous woodland plantation (WD2) |
|---------------------|-------------|---------------------------------------|--|
| Year 0,1,2 | 7.5 | 100 | 0 |
| Year 3-4 | 2.1 | 0 | 100 |
| Year 5-6 | 1.7 | 0 | 100 |
| Year 7-8 | 1.2 | 0 | 100 |
| Total felled | 12.5 | 60 | 40 |

Recently established (2005-2012) (Mixed) Broadleaved Woodland WD1 plantation totalling 3.6 ha will be lost within the footprint of the proposed (eastern) screening berm, IBA Facility, surface water holding pond, surface water attenuation lagoon, and constructed wetland. While these plantations are of recent origin, artificial structure, and of low species diversity with few woodland specialists present and ground flora still dominated by the grasses which covered these areas during agricultural use, the use of native species (ash and alder) imparts some degree of naturalness.

Considering that these areas were established for commercial purposes and would ultimately be harvested, and are subject to forestry management, they are of lower value than long-established woodlands. While potentially of limited value to local wildlife, these plantations do not currently correspond to any ecologically valuable habitat. Considering these factors and that they will be replaced with similar planting following completion of proposed construction, a **Short-Term Moderate Impact** is envisaged.

Recently established Mixed Broadleaved/Conifer Woodland WD2 totalling 7.2 ha will be lost within the footprint of the proposed screening berm running along the western boundary. It is of similar or value to the woodlands described above, and when taking re-planting into account, the same **Short-Term Moderate Impact** is envisaged.

Recently established Conifer Plantation WD4 totalling 0.5ha will be lost within the footprint of the proposed screening berm east of the IBA Facility. This woodland type is of lower value in its own right to those described above due to the dominance of non-native conifers, but is of value to local wildlife as a source of food and cover. When taking re-planting into account, a **Short-Term Slight Impact** is envisaged.

A culvert will be installed within the Knockharley Stream, this will require temporary diversion of Knockharley Stream and instream works and will result in the disturbance of the habitat. The river is Eroding/Upland River (FW1) is of Local Importance (higher value) as it acts as a corridor for local wildlife and Otter use has been recorded. The impact on Eroding/Upland River (FW1) is deemed to be **Permanent Slight Impact**.

A section of Eroding Rivers FW 1 represented by the Flemingstown 08 (Knockharley) stream is the subject of a permitted stream diversion at the northern end of the permitted landfill (phase 7), and the channel runs in close proximity to the proposed wetland (which would discharge to the stream) before intersecting a section of the north-eastern screening berm. A culvert is proposed to be installed at this point, with an access road running along the berm over the stream and leading to the proposed wetland. A baffled overflow chute on the lip of the proposed attenuation pond would also discharge to the Flemingstown 08 downstream of the culvert.

Installation of the culvert will require a temporary stream diversion, resulting in disturbance of this habitat. The stream is of Local Importance (higher value) as it acts as a corridor for local wildlife and Otter use has been recorded. The impact arising from the culvert installation is deemed to be a *Permanent-Slight Impact*.

No protected flora were identified within the site and therefore there will be no impact to protected flora as a result of the proposed development.

No protected flora were identified on-site during 2019 surveys and therefore there will be no impact to protected flora as a result of the proposed development.

Areas of Ornamental/Non-native Shrub/Scrub WS3/WS1 Mosaic totalling 0.2 ha which border the northern and southern sides of the main site access road approaching the landfill offices will be lost within the footprint of proposed screening berms. While scrub is of moderate value to local wildlife, it's transient nature and rapid development means that while it is often cleared, it is constantly forming in new locations. Considering this attendant state of flux and the small amount of this habitat within the proposed berm footprints, a *Short-Term Imperceptible Impact* is envisaged.

A section of Drainage Ditches FW 4 129m in length will be lost within the footprint of the proposed surface water holding pond, surface water attenuation lagoon, and (north-eastern) screening berm. Taking into account the semi-natural character this area has taken on in the absence of management and its value to local wildlife, a *Permanent-Moderate Impact* is envisaged.

5.1.2 Operational Phase Impacts

10.5.3 Operational Phase

10.5.3.3 Water Quality

The operation of the facility to date has not had a negative impact on surface water quality. The southern and northern surface water management systems will direct surface water flows from the site to the attenuation ponds and wetlands prior to discharge to the Knockharley Stream. The pond will attenuate flows and allow suspended solids to settle. The outlet from the pond can be shut to prevent discharge to watercourse in the event of a suspected contamination incident. Automated monitors will be triggered to close if monitored water quality levels rise/fall above/below acceptable levels or trigger levels; isolating contaminated water. Water is discharged from the pond and through a constructed wetland for final polishing before discharge to the receiving watercourse. Therefore, the potential for sediment release to watercourses is low during the operational phase.

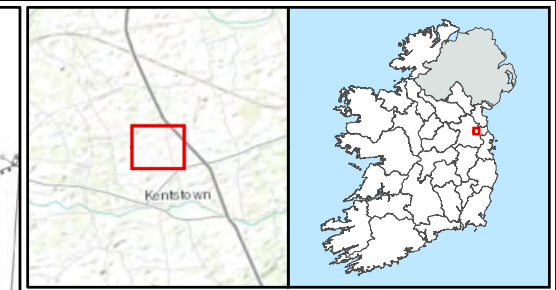
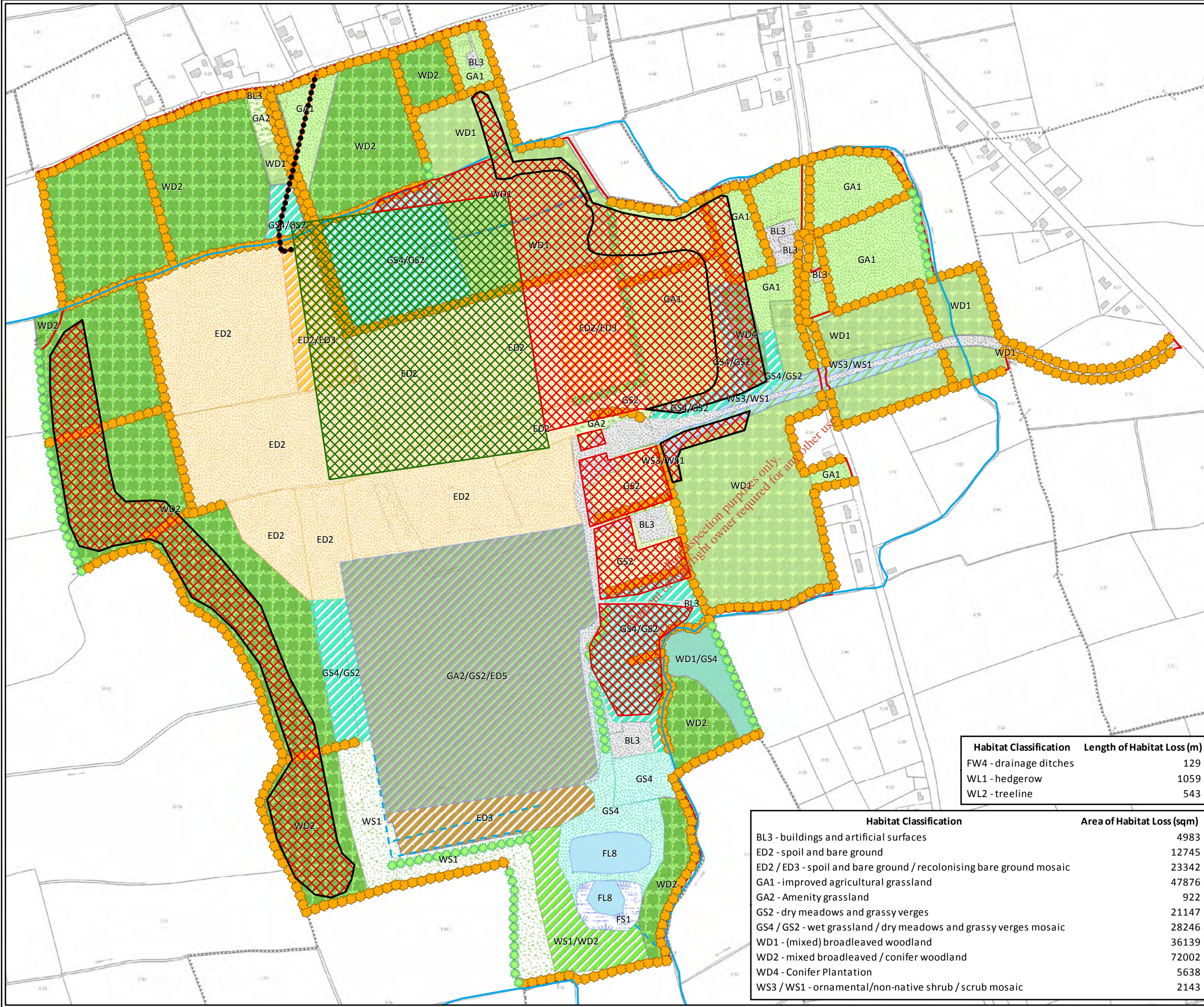
To mitigate the risk of IBA dust or hydrocarbons leaks from vehicles on roads surrounding the IBA facility contaminating the storm water, provision has been made in the design to install french drains adjacent to perimeter roads.

During operations the outfall from this French drainage network will discharge to the leachate collection system. Post capping the outfall will be redirected to the holding pond via a petrol interceptor into the northern storm water management system.

Due to the insignificant increase in potential run-off from the site **no impact** is envisioned on the water quality of Knockharley Stream.

In the unlikely event of direct overflow discharges from the proposed attenuation pond, a *Temporary-Slight* impact is predicted.

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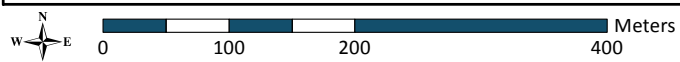


- Proposed Overhead Electricity
- ▭ Berm
- ▭ Planning Boundary
- ▭ Permitted elements not yet
- ▭ Proposed elements
- Habitat**
- FW1 - eroding river
- - - FW4 - drainage ditches
- WL1 - hedgerow
- WL2 - treeline
- ▭ BL3 - buildings and artificial surfaces
- ▭ ED2 - spoil and bare ground
- ▭ ED2 / ED3 - spoil and bare ground /
- ▭ ED3 - recolonising bare ground
- ▭ FL8 - artificial lakes and ponds
- ▭ FS1 - reed and large sedge swamps
- ▭ GA1 - improved agricultural grassland
- ▭ GA1 / GS4 - improved agricultural grassland /
- ▭ GA2 - Amenity grassland
- ▭ GA2/GS2/ED5 - amenity grassland / dry meadows and grassy verges / refuse and other
- ▭ GS2 - dry meadows and grassy verges
- ▭ GS4 - wet grassland
- ▭ GS4 / GS2 - wet grassland / dry meadows and
- ▭ WD1 - (mixed) broadleaved woodland
- ▭ WD1 / GS4 - (mixed) broadleaved woodland /
- ▭ WD2 - mixed broadleaved / conifer woodland
- ▭ WD4 - Conifer Plantation
- ▭ WS1 - scrub
- ▭ WS1 / WD2 - scrub / mixed broadleaved-
- ▭ WS3 / WS1 - ornamental/non-native shrub /

| Habitat Classification | Length of Habitat Loss (m) |
|------------------------|----------------------------|
| FW4 - drainage ditches | 129 |
| WL1 - hedgerow | 1059 |
| WL2 - treeline | 543 |

| Habitat Classification | Area of Habitat Loss (sqm) |
|---|----------------------------|
| BL3 - buildings and artificial surfaces | 4983 |
| ED2 - spoil and bare ground | 12745 |
| ED2 / ED3 - spoil and bare ground / recolonising bare ground mosaic | 23342 |
| GA1 - improved agricultural grassland | 47876 |
| GA2 - Amenity grassland | 922 |
| GS2 - dry meadows and grassy verges | 21147 |
| GS4 / GS2 - wet grassland / dry meadows and grassy verges mosaic | 28246 |
| WD1 - (mixed) broadleaved woodland | 36139 |
| WD2 - mixed broadleaved / conifer woodland | 72002 |
| WD4 - Conifer Plantation | 5638 |
| WS3 / WS1 - ornamental/non-native shrub / scrub mosaic | 2143 |

| | |
|-------------------|---------------------------------|
| TITLE: | Habitat Loss |
| PROJECT: | Knockharley Landfill, Co. Meath |
| FIGURE NO: | 3 |
| CLIENT: | Knockharley Landfill Ltd. |
| SCALE: | 1:6000 |
| REVISION: | 0 |
| DATE: | 21/10/2019 |
| PAGE SIZE: | A3 |



5.2 Mitigation

No additional mitigation measures other than those detailed in the EIAR (Section 10.6 Mitigation Measures in Ch. 10 Biodiversity) are required.

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6 RESIDUAL IMPACTS

As in the preceding sections, original text and numbering from the EIAR are included in grey text boxes, with additions or alterations arising from additional information included in bold below.

10.7 Residual Impacts after Mitigation

A certain amount of permanent habitat loss will be associated with the footprint of the proposed development, however this will be small relative to the value of habitats available on the site.

With the application of the above mitigation measures which includes monitoring, there will be no significant residual impacts from this development are envisaged.

The permanent loss of 5 ha of moderate value semi-natural grasslands and 1,602 m of established treelines and hedgerows will be associated with the footprint of the proposed development.

A total of 129m of Drainage Ditches with semi-natural characteristics will be lost within the proposed development footprint. This will be offset by the proposed wetland.

A total of 31m of Eroding Rivers FW1 of low-moderate ecological value overlapped by the proposed screening berm will be altered by culvert installation.

The woodlands on-site which are of recent origin and still relatively artificial in character due to their immaturity and silvicultural origin. New planting will replace these during the operational phase.

Considering the low to moderate value of habitats within the proposed development footprint, proposed re-planting of forestry and the application of mitigation measures detailed in the EIAR, there will be no significant residual impacts to habitats and flora from this development.

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7 REFERENCES

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Appendix 1

Annex 1 Grassland Habitats Comparison

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Typical species lists are taken from NPWS (2013) and NPWS (2019) (Article 17 Habitats Assessments Reports). High-quality indicator species are given in NPWS (2013).

| [6510] Lowland Hay Meadows Typical Species (High-Quality species denoted by H) | Present at Knockharley (in GS4/GS2 in proposed development footprint) | Present at Knockharley (in GS2 in proposed development footprint) |
|--|---|---|
| <i>Alopecurus pratensis</i> | | |
| <i>Bromus racemosus</i> H | | |
| <i>Centaurea nigra</i> | | |
| <i>Crepis capillaris</i> | | |
| <i>Dactylorhiza fuchsia</i> | | |
| <i>Daucus carota</i> | | |
| <i>Filipendula ulmaria</i> | ✓ (not common onsite) | |
| <i>Heracleum sphondylium</i> | | |
| <i>Hordeum secalinum</i> H | | |
| <i>Hypochaeris radicata</i> | | |
| <i>Knautia arvensis</i> H | | |
| <i>Lathyrus pratensis</i> | ✓ | |
| <i>Leontodon autumnalis</i> | | |
| <i>Leontodon hispidus</i> | | |
| <i>Leucanthemum vulgare</i> H | (not common onsite) | |
| <i>Lotus corniculatus</i> H | | |
| <i>Pimpinella major</i> H | | |
| <i>Plantago lanceolata</i> | | ✓ |
| <i>Prunella vulgaris</i> | | |
| <i>Ranunculus acris</i> | ✓ | ✓ |
| <i>Rhinanthus minor</i> H | | |
| <i>Sanguisorba officinalis</i> H | | |
| <i>Tragopogon pratensis</i> H | | |
| <i>Trifolium pratense</i> | ✓ | ✓ |
| <i>Trisetum flavescens</i> | | |
| <i>Vicia cracca</i> | ✓ | ✓ |
| All orchid species H | | |
| Total | 6 | 4 |
| Minimum required for Annex I status (NPWS 2013) | 7 | 7 |
| Other factors required for Annex I status | Flower rich, cut 1-2 times per year after grasses flower | Flower rich, cut 1-2 times per year after grasses flower |
| Conclusion | Not Annex I | Not Annex I |

[6510] Lowland Hay Meadows can be classified within the IVC community **GL3E *Festuca rubra* – *Rhinanthus minor* grassland**.

The following description of the GL3E *Festuca rubra* – *Rhinanthus minor* grassland community is from the IVC portal on the NBDC website:

Vegetation

The main grass species in this rather attractive community are *Anthoxanthum odoratum*, *Holcus lanatus*, *Festuca rubra*, *Agrostis capillaris* and *Cynosurus cristatus*. Forb cover tends to be high with *Plantago lanceolata* and *Trifolium pratense* being abundant, while other constant forbs include *Trifolium repens*, *Ranunculus acris*, *Cerastium fontanum*, *Rumex acetosa* and the hemiparasite *Rhinanthus minor*. Forbs are tall-growing in comparison to the other drier grassland communities. *Filipendula ulmaria* occurs on wetter sites. Several common moss species form the bryophyte layer with *Calliergonella cuspidata* and *Brachythecium rutabulum* being the most frequent.

Ecology

The *Festuca rubra* – *Rhinanthus minor* grassland is significant for being a community of neutral lowland hay meadows, generally occurring on well-draining, mineral soils of fairly average fertility.

Sub-communities

No sub-communities are described

Similar communities

This grassland differs from the other main meadow community, GL3C *Festuca rubra* – *Trifolium pratense* grassland, by being less base-rich and less fertile. Coarse grasses such as *Agrostis stolonifera*, *Dactylis glomerata* and *Arrhenatherum elatius* are less common here, but it is the high frequency of *Rhinanthus minor* which is the chief indicator for this community and this species is often plentiful.

Conservation value

This is a grassland community of medium species richness. It is the community which corresponds most closely with the EU HD Annex I habitat 6510 Lowland hay meadows, but has some minor affinity with the EU HD Annex I priority habitat 6210 Orchid-rich calcareous grassland*.

Management

These swards are managed as grazing land (typically for cattle) and/or mown for hay. Cutting may occur once or twice a year between May and September. The main threats to these grasslands include improvement and abandonment."

(<http://www.biodiversityireland.ie/projects/national-vegetation-database/irish-vegetation-classification/explore/gl3e/>)

Typical species lists are taken from NPWS (2013) and NPWS (2019) (Article 17 Habitats Assessments Reports). High-quality indicator species are given in NPWS (2013).

| [6410] <i>Molinia</i> Meadows on calcareous, peaty or clayey-silt-laden soils Typical Species (High-Quality species denoted by H) | Present at Knockharley (in GS4/GS2 in proposed development footprint) |
|---|---|
| <i>Achillea ptarmica</i> | |
| <i>Carex echinata</i> | ✓ (not common onsite) |
| <i>Carex flacca</i> | ✓ |
| <i>Carex nigra</i> | ✓ |
| <i>Carex panicea</i> | |
| <i>Carex pulicaris</i> H | |
| <i>Carex viridula</i> , | |
| <i>Carum verticillatum</i> , H | |
| <i>Cirsium dissectum</i> H | |
| <i>Crepis paludosa</i> , H | |
| <i>Equisetum palustre</i> , | |
| <i>Filipendula ulmaria</i> , | (not common onsite) |
| <i>Galium palustre</i> , | |
| <i>Galium uliginosum</i> , H | |
| <i>Juncus acutiflorus</i> , | |
| <i>Juncus articulatus</i> , | |
| <i>Juncus conglomeratus</i> , H | |
| <i>Lathyrus palustris</i> , H | |
| <i>Ophioglossum vulgatum</i> , H | |
| <i>Lotus pedunculatus</i> , | ✓ |
| <i>Luzula multiflora</i> , | ✓ (not common onsite) |
| <i>Mentha aquatica</i> , | |
| <i>Molinia caerulea</i> , | |
| <i>Potentilla anglica</i> , | |
| <i>Potentilla erecta</i> , | |
| <i>Ranunculus flammula</i> , | |
| <i>Succisa pratensis</i> , | |
| <i>Viola palustris</i> , | |
| <i>Viola persicifolia</i> . H | |
| All orchid species H | |
| | |
| Total | 6 |
| Minimum required for Annex I status (NPWS 2013) | 7 |

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| | |
|--|---|
| [6410] <i>Molinia</i> Meadows on calcareous, peaty or clayey-silt-laden soils Typical Species (High-Quality species denoted by H) | Present at Knockharley (in GS4/GS2 in proposed development footprint) |
| Other factors required for Annex I status | Strong indicator species such as <i>Succisa pratensis</i> and <i>Juncus acutiflorus</i> and <i>Filipendula ulmaria</i> and <i>Cirsium dissectum</i> common. |
| Conclusion | Not Annex I |

[6410] *Molinia* Meadows can be classified within the IVC community **GL1C *Molinia caerulea* – *Succisa pratensis* grassland**

The following description of the GL1C *Molinia caerulea* – *Succisa pratensis* grassland community is from the IVC portal on the NBDC website:

Vegetation

This is typically a species-rich grassland community with a number of constant species. *Molinia caerulea* is often an abundant species, but tends not to form large, dominating tussocks and may even be absent. *Succisa pratensis* is a strong indicator and can be plentiful, while *Calliergonella cuspidata* is usually abundant beneath the sward. Other constant graminoids include *Carex panicea*, *Carex flacca*, *Juncus acutiflorus*, *Holcus lanatus*, *Festuca rubra* and *Anthoxanthum odoratum*. Apart from *Succisa*, the main forbs are *Potentilla erecta*, *Ranunculus acris*, *Trifolium* spp., *Plantago lanceolata*, *Prunella vulgaris*, *Filipendula ulmaria* and *Cirsium dissectum*. *Briza media* and *Carex pulicaris* occur on the more calcareous soils.

Ecology

The *Molinia caerulea* – *Succisa pratensis* grassland is a wet grassland community that primarily occurs in fairly low-lying areas on gleys but also on basin peats. These areas are often seasonally flooded (e.g. callows grassland). The soils are usually fairly acidic, markedly infertile and organic.

Sub-communities

No sub-communities are currently defined for this community.

Similar communities

GL1D *Molinia caerulea* – *Potentilla erecta* – *Agrostis stolonifera* grassland is related to this community but is less rich in number of species and *Molinia caerulea* tends to dominate there in a taller, tussocky sward.

Conservation value

This is a species-rich grassland community. A high proportion of these plots (particularly those with *Molinia caerulea* and *Cirsium dissectum*) come from grassland classified as EU HD Annex I habitat 6410 *Molinia* meadows. Sites with good populations of *Succisa pratensis* can also be important for the EU HD Annex II species Marsh Fritillary (*Euphydryas aurinia*) as this is the main food plant for this butterfly species.

Management

These swards are managed as rough grazing land (typically for cattle) and/or through a traditional regime of mowing during the drier summer months (typically around August). In wetter years, mowing may not be possible. The main threats to these grasslands include improvement, abandonment and afforestation."

[\(http://www.biodiversityireland.ie/projects/national-vegetation-database/irish-vegetation-classification/explore/gl1c/\)](http://www.biodiversityireland.ie/projects/national-vegetation-database/irish-vegetation-classification/explore/gl1c/)

Appendix 2

Irish Vegetation Classification /ERICA Analysis

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Table 4: Results of ERICA analysis (see figure 2 for plot locations)

| Plot | Code | Community | Group | Division | Max | Type | Link |
|------|------|--|--|------------|------|--------------|---------------------|
| Q1 | SM4A | Festuca rubra - Agrostis stolonifera | Festuca rubra - Seriphidium maritimum | Saltmarsh | 48.9 | Transitional | Web |
| Q2 | GL4A | Agrostis capillaris - Trifolium repens | Nardus stricta - Galium saxatile | Grasslands | 72.4 | Assigned | Web |
| Q3 | GL4A | Agrostis capillaris - Trifolium repens | Nardus stricta - Galium saxatile | Grasslands | 82.0 | Assigned | Web |
| Q4 | GL2C | Holcus lanatus - Lolium perenne | Agrostis stolonifera - Ranunculus repens | Grasslands | 28.8 | Transitional | Web |
| R1 | GL2C | Holcus lanatus - Lolium perenne | Agrostis stolonifera - Ranunculus repens | Grasslands | 63.1 | Assigned | Web |
| R2 | GL2A | Agrostis stolonifera - Ranunculus repens | Agrostis stolonifera - Ranunculus repens | Grasslands | 44.0 | Transitional | Web |
| Q5 | GL2B | Juncus effusus - Holcus lanatus | Agrostis stolonifera - Ranunculus repens | Grasslands | 76.1 | Assigned | Web |
| Q6 | GL2C | Holcus lanatus - Lolium perenne | Agrostis stolonifera - Ranunculus repens | Grasslands | 15.8 | Transitional | |

An excerpt from the ERICA manual (Perrin, 2018), on interpreting results is included below.

“Interpreting your results

The analysis procedure uses a version of fuzzy clustering called noise clustering. More details on this can be found in the IVC technical reports found here. In brief, what this procedure does is assign each of the plots in the input table a degree of membership to each of the communities defined by the IVC. Membership is also assigned to a ‘noise’ class which represents outliers not adequately described by the current IVC scheme. All these membership values total 1. Under ‘Type’ in the results table (Fig. 4), each input plot is categorised based on membership values following the definitions in Table 1.

Table 1. Categorising types of plots using fuzzy membership results from noise clustering analysis (after Wiser & de Cáceres 2013).

| Plot Type | Definition |
|--------------|---|
| Assigned | The plot has membership ≥ 0.5 for one of the vegetation communities and therefore relates to the core definition of that vegetation community. |
| Unassigned | The plot has membership ≥ 0.5 for the noise class and is poorly represented by the current classification scheme. |
| Transitional | The plot has membership < 0.5 for all vegetation communities and for the noise class. It falls within the scope of the current classification scheme but does not relate to the core definition of any of the vegetation communities. |

Under ‘Max’ in the table is the maximum fuzzy membership value (presented here as a percentage rather than a [0, 1] value) and under ‘Code’ is the code of the community to which that maximum membership value has been assigned². The ‘Community’, ‘Group’ and ‘Division’ relating to that code are presented. The table can be navigated, ordered and searched as before. The ‘Link’ column provides a series of buttons each of which links to the relevant community description page on the NBDC website; for an overview of the IVC hierarchy, you should refer here. Mouse over truncated entries to see the full text. Mouse over the column headings for reminders of the data types.

Note that plots defined as transitional are still assigned to a community (or the noise class) under ‘Code’ in this manner. Caution should be exercised in interpreting these transitional results, especially when the ‘Max’ value is particularly low and it may be desirable to exclude these plots from subsequent analysis or to handle them differently. Note also that when you download the results, you are presented with the membership values of each plot for all vegetation communities; this should aid you in interpreting the results.

The communities of the IVC have been defined using quantitative data, and data of this nature are preferable when attempting to classify vegetation. Some degree of caution should be exercised when interpreting the results from presence/absence data.”

Q1

The transitional assignment of plot Q1 to the saltmarsh community SM4A results from the dominance *Festuca rubra* and *Agrostis stolonifera*:

"This vegetation usually comprises a rank sward dominated by *Festuca rubra* and *Agrostis stolonifera*, which are the only constants. *Glaux maritima*, *Plantago maritima* and *Triglochin maritimum* are each frequent and there are a number of occasional associates including *Leontodon autumnalis*, *Juncus gerardii*, *Trifolium repens*, *Atriplex prostrata*, *Cochlearia officinalis*, *Armeria maritima*, *Plantago coronopus* and *Aster tripolium*." (community description)(<http://www.biodiversityireland.ie/projects/national-vegetation-database/irish-vegetation-classification/explore/sm4a/>).

Based on its location c. 19 km inland and lack of halophytes, this habitat is clearly not saltmarsh, and its (transitional) assignment is based on the dominance of two species which are in fact fairly common across habitats. *Festuca rubra* is present in NBDC records for grid square N96 (10km grid square overlapping site).

The history of disturbance in this area may have allowed them to dominate in an unusual setting, with dry but heavy and compacted soil supporting the sparse sward present in this marginal area fringing the more characteristic rank grassland covering this field.

Q2 & Q3

These plots were assigned firmly to the GL4A *Agrostis capillaris* – *Trifolium repens* grassland community, with the following descriptions given on the IVC portal on the NBDC website-

Vegetation

The main grass species in this community are *Agrostis capillaris* (which dominates), *Anthoxanthum odoratum*, *Holcus lanatus* and *Festuca rubra*. Among the forbs, *Trifolium repens* and *Rumex acetosa* are constants, with *Cerastium fontanum*, *Ranunculus repens* and *Plantago lanceolata* also frequent. Of the other species which may occur, some are more characteristic of the uplands (e.g. *Galium saxatile* and *Potentilla erecta*), while others are more characteristic of lowland, dry mesotrophic swards (e.g. *Cynosurus cristatus*, *Ranunculus acris* and *Hypochaeris radicata*) or wet grassland (e.g. *Juncus effusus* and *Lotus pedunculatus*). Some minor degree of improvement is signified by the frequency of *Lolium perenne*. The main component of the bryophyte layer is *Rhytidiadelphus squarrosus*.

Ecology

The *Agrostis capillaris* – *Trifolium repens* grassland is a variable and rather poorly defined semi-improved community of the lower uplands, which occurs mainly on drained mineral soils or rather peaty gleys.

Conservation value

This is a fairly species-poor grassland community with relatively little recognised conservation value."

(<http://www.biodiversityireland.ie/projects/national-vegetation-database/irish-vegetation-classification/explore/gl4a/>)

These two plots are characteristic of the dense rank sward present in much of the GS4/GS2 fields within the footprint of the proposed biological treatment facility and leachate management facility extension.

Q4, R1, Q6

Plot R1 was assigned firmly to the GL2C *Holcus lanatus* – *Lolium perenne* grassland community, while Q4 and Q6 were transitional with lower levels of similarity (28.8 and 15.8 respectively). This community is described as-

Vegetation

This is a very species-poor assemblage and there are only a few constant species. *Holcus lanatus*, *Agrostis stolonifera* and *Lolium perenne* form the bulk of the medium-height sward alongside *Ranunculus repens* and *Trifolium repens*. *Cerastium fontanum* is frequent and, together with *Lolium perenne* and *Trifolium repens*, is indicative of the agriculturally-improved nature of the community. *Poa trivialis* would have been frequent in this community in the past as it was included in old seed mixes; it is probably less frequent now.

Ecology

The *Holcus lanatus* – *Lolium perenne* grassland is a variable semi-improved community of wet pastures and meadows found commonly across the country, that occurs on gleyed or drained mineral soils. Soils are fairly acidic and, despite the agricultural improvement, the vegetation suggests that they are only mildly fertile.

Conservation value

This is a species-poor grassland community of relatively low conservation value.

Management

These swards are managed as improved grazing land (typically for cattle) and/or for silage. Fertiliser application and re-seeding will typically occur periodically. The main threats to these grasslands include further improvement and abandonment.”

[\(http://www.biodiversityireland.ie/projects/national-vegetation-database/irish-vegetation-classification/explore/gl2c/\)](http://www.biodiversityireland.ie/projects/national-vegetation-database/irish-vegetation-classification/explore/gl2c/)

Plot R1 is located within a uniform sward dominated by *Holcus lanatus*; other than this however, none of the species listed in the above description are present; as such although firmly assigned statistically to GL2C based on the dominance of *Holcus lanatus*, the other species recorded in R1 are not reflective of the description. Q4 contains *Agrostis stolonifera* and *Holcus lanatus*, although not in the dominant proportions described above. Q6 contains *Agrostis stolonifera* and *Holcus lanatus*, in even lower proportions, resulting in a transitional assignment.

GL2C is described as a species-poor assemblage with few constants; the low number of relatively common species recorded in plots Q4, Q6 & R1 is reflective of this.

R2

This plot was categorised on a transitional basis as GL2A *Agrostis stolonifera* – *Ranunculus repens* marsh-grassland based on the dominance of *Agrostis stolonifera*, with none of the other constants, a number of which are associated with marshy or wet grassland vegetation present (either in R2 or the surrounding area). This community is described as-

Vegetation

Agrostis stolonifera is the main species of this marshy community, with *Ranunculus repens*, *Galium palustre* and *Potentilla anserina* being the only other constants. These are frequently accompanied by *Carda.mine pratensis*, *Filipendula ulmaria* and *Trifolium repens*, and less often by *Mentha aquatica*, *Leontodon autumnalis* and *Senecio aquaticus*. The community differs from others in this group (GL2) in its higher forb component and the presence of more species tolerant of seasonal flooding. *Calliergonella cuspidata* tends to be the only bryophyte. The vegetation is typically calf-height.

Ecology

The *Agrostis stolonifera* – *Ranunculus repens* marsh-grassland is a variable grouping of vegetation from mesotrophic, wet grassland and marsh on gleys and basin peats in the lowlands. Soils are relatively base-rich, quite fertile and fairly organic.

Sub-communities

Two sub-communities have been described. The *Holcus lanatus* – *Juncus effusus* sub-community (GL2Ai) is the more typical and variable sub-community whilst the *Potentilla anserina* – *Carex hirta* sub-community (GL2Aii) represents wetter, seasonally inundated and probably trampled vegetation.

Conservation value

This is a species-poor grassland community.”

[\(http://www.biodiversityireland.ie/projects/national-vegetation-database/irish-vegetation-classification/explore/gl2a/\)](http://www.biodiversityireland.ie/projects/national-vegetation-database/irish-vegetation-classification/explore/gl2a/)

R2 and the surrounding grasslands do not support any of the species included in the classification found in marshy habitats (no *Filipendula ulmaria*, *Iris pseudacorus* or *Equisetum fluviatile* are present).

Q5

This plot was assigned to GL2B *Juncus effusus* – *Holcus lanatus* grassland based on the dominance of *Holcus lanatus*, *Juncus effusus* and *Agrostis stolonifera*. This community is described as-

“Vegetation

The main graminoids in this rushy, wet grassland community are *Holcus lanatus*, *Juncus effusus*, *Agrostis stolonifera* and *Anthoxanthum odoratum*, which form a fairly tall, rank sward while the forb component consists largely of *Ranunculus repens*, *Ranunculus acris*, *Trifolium repens* and *Rumex acetosa*. Frequent species include *Cirsium palustre*, *Cerastium fontanum*, *Festuca rubra* and *Juncus acutiflorus*. *Calliergonella cuspidata* is the most frequent bryophyte and can form a dense layer with *Brachythecium rutabulum*.

Ecology

This common grassland community is found across the country on lowland farmland with impeded drainage on flat ground or gentle slopes. It is typical of relatively unimproved, wet pasture and is encountered on gleyed soils and sometimes on basin peats which are mildly fertile.

Conservation value

This is a fairly species-poor grassland community of relatively low conservation value.”

(<http://www.biodiversityireland.ie/projects/national-vegetation-database/irish-vegetation-classification/explore/gl2b/>)

The description above fits Q5 quite well; it is located in a strip of rough, wet grassland bordering intensively managed pasture. The presence of *Lathyrus pratensis* and 2 sedges *Carex leporina* and *Carex nigra* adds some interest, but these are fairly common across less-intensively managed habitats.

Appendix 3

Grassland Botanical Survey Results

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Table 5: Q1 (Quadrat 1)

| Species Composition & Cover | | | |
|-----------------------------|-------|----------------------------------|------------------|
| Common Name | | Scientific Name | Percentage Cover |
| Red Fescue | | <i>Festuca rubra</i> | 70 % |
| Creeping Bent-grass | | <i>Agrostis stolonifera</i> | 50 % |
| Red Clover | | <i>Trifolium pratense</i> | 40 % |
| Yorkshire fog | | <i>Holcus lanatus</i> | 30 % |
| Timothy Grass | | <i>Phleum pratense</i> | 8 % |
| White Clover | | <i>Trifolium repens</i> | 7 % |
| Creeping Thistle | | <i>Cirsium arvense</i> | 3 % |
| Dandelion | | <i>Taraxacum officinale</i> Agg. | 3 % |
| Perennial Rye-grass | | <i>Lolium perenne</i> | <1 % |
| Cut-leaved Crane's-bill | | <i>Geranium dissectum</i> | <1 % |
| Structural Data | | | |
| Median Vegetation Height | | Vegetation Cover | |
| Graminoids | Forbs | Graminoids | Forbs |
| 60 cm | 35 cm | 95 % | 45 % |



Plate 15: Q1

Table 6: Q2 (Quadrat 2)

| Species Composition & Cover | | | |
|--------------------------------|--|------------------|-------|
| Common Name | Scientific Name | Percentage Cover | |
| Sweet Vernal Grass | <i>Anthoxanthum odoratum</i> | 40 % | |
| Common Bent-grass | <i>Agrostis capillaris</i> | 40 % | |
| Soft Rush | <i>Juncus effusus</i> | 30 % | |
| Hard Rush | <i>Juncus acutus</i> | 25 % | |
| Common Couch Grass | <i>Elymus repens</i> | 20 % | |
| Hairy Sedge | <i>Carex_hirta</i> | 15 % | |
| Cocksfoot Grass | <i>Dactylis glomerata</i> | 10 % | |
| Greater Bird's Foot Trefoil | <i>Lotus pedunculatus</i> | 10 % | |
| Timothy-grass | <i>Phleum pratense</i> | 5 % | |
| Meadow Buttercup | <i>Ranunculus acris</i> | 5 % | |
| False Oat-grass | <i>Arrhenatherum elatius</i> | 5 % | |
| Bush Vetch | <i>Vicia sepium</i> | 5 % | |
| Creeping Thistle | <i>Cirsium arvense</i> | 3 % | |
| Yorkshire Fog | <i>Holcus lanatus</i> | 3 % | |
| Dandelion | <i>Taraxacum officinale</i> | 1 % | |
| Heath Woodrush | <i>Luzula multiflora</i> subsp. <i>Congesta</i> | <1 % | |
| Structural Data | | | |
| Median Vegetation Height | | Vegetation Cover | |
| Graminoids | Forbs | Graminoids | Forbs |
| 50 cm (80 cm) * | 25 cm | 100 % | 20 % |



Plate 16: Q2

Table 7: Q3 (Quadrat 3)

| Species Composition & Cover | | | |
|-----------------------------|-------|----------------------------|------------------|
| Common Name | | Scientific Name | Percentage Cover |
| Common Bent-grass | | <i>Agrostis capillaris</i> | 55 % |
| Hard Rush | | <i>Juncus acutus</i> | 25 % |
| Yorkshire Fog | | <i>Holcus lanatus</i> | 20 % |
| Timothy-grass | | <i>Phleum pratense</i> | 20 % |
| Field Horsetail | | <i>Equisetum arvense</i> | 15 % |
| Silverweed | | <i>Potentilla reptans</i> | 2 % |
| Ash | | <i>Fraxinus excelsior</i> | 2 % |
| Meadow Buttercup | | <i>Ranunculus acris</i> | 1 % |
| Structural Data | | | |
| Median Vegetation Height | | Vegetation Cover | |
| Graminoids | Forbs | Graminoids | Forbs |
| 50 cm | 30 cm | 100 % | 5 % |



Plate 17: Q3

Table 8: Q4 (Quadrat 4)

| Species Composition & Cover | | | |
|-----------------------------|-------|-----------------------------|------------------|
| Common Name | | Scientific Name | Percentage Cover |
| Meadow Vetchling | | <i>Lathyrus pratensis</i> | 80 % |
| Common Bent-grass | | <i>Agrostis capillaris</i> | 50 % |
| Creeping Bent-grass | | <i>Agrostis stolonifera</i> | 30 % |
| Meadow Buttercup | | <i>Ranunculus acris</i> | 20 % |
| Dandelion | | <i>Taraxacum officinale</i> | 15 % |
| Yorkshire Fog | | <i>Holcus lanatus</i> | 15 % |
| Timothy-grass | | <i>Phleum pratense</i> | 10 % |
| Lesser Stitchwort | | <i>Stellaria graminea</i> | 10 % |
| Structural Data | | | |
| Median Vegetation Height | | Vegetation Cover | |
| Graminoids | Forbs | Graminoids | Forbs |
| 100 cm | 70 cm | 95 % | 85 % |



Plate 18: Q4

Table 9: Q5 (Quadrat 5)

| Species Composition & Cover | | | |
|-----------------------------|-------|------------------------------|------------------|
| Common Name | | Scientific Name | Percentage Cover |
| Yorkshire Fog | | <i>Holcus lanatus</i> | 30 |
| Soft Rush | | <i>Juncus effusus</i> | 15 |
| Perennial Rye-grass | | <i>Lolium perenne</i> | 15 |
| Creeping Bent-grass | | <i>Agrostis stolonifera</i> | 10 |
| Great Willowherb | | <i>Epilobium hirsutum</i> | 5 |
| Sweet Vernal Grass | | <i>Anthoxanthum odoratum</i> | 3 |
| Red Fescue | | <i>Festuca rubra</i> | 2 |
| Meadow Vetchling | | <i>Lathyrus pratensis</i> | 2 |
| Oval Sedge | | <i>Carex leporina</i> | 1 |
| Black Sedge | | <i>Carex nigra</i> | <1 % |
| Red Clover | | <i>Trifolium pratense</i> | <1 % |
| Structural Data | | | |
| Median Vegetation Height | | Vegetation Cover | |
| Graminoids | Forbs | Graminoids | Forbs |
| 85 cm | 70 cm | 100 % | 6 % |



Plate 19: Q5

Table 10: Q6 (Quadrat 6)

| Species Composition & Cover | | | |
|-----------------------------|-------|-----------------------------|-----------------|
| Median Vegetation Height | | Vegetation Cover | |
| Graminoids | Forbs | Graminoids | Forbs |
| 85 cm | 70 cm | 100 % | 6 % |
| Common Name | | Scientific Name | Scientific Name |
| Cock's Foot Grass | | <i>Dactylis glomerata</i> | 80 % |
| Creeping Thistle | | <i>Cirsium arvense</i> | 8 % |
| Dandelion | | <i>Taraxacum officinale</i> | 5 % |
| Nettle | | <i>Urtica dioica</i> | 3 % |
| Cleavers | | <i>Galium aparine</i> | 2 % |
| Yorkshire Fog | | <i>Holcus_lanatus</i> | 1 % |
| Creeping Bent-grass | | <i>Agrostis stolonifera</i> | 1 % |
| Timothy-grass | | <i>Phleum pratense</i> | 1 % |
| Creeping Buttercup | | <i>Ranunculus repens</i> | <1 % |
| Structural Data | | | |
| Median Vegetation Height | | Vegetation Cover | |
| Graminoids | Forbs | Graminoids | Forbs |
| 110 cm | 60 cm | 95 % | 30 % |



Plate 20: Q6

Table 11: Q7 (Quadrat 7)

| Species Composition & Cover | | | |
|-----------------------------|-------|----------------------------------|------------------|
| Common Name | | Scientific Name | Percentage Cover |
| Perennial Rye-grass | | <i>Lolium perenne</i> | 70 % |
| Yorkshire Fog | | <i>Holcus lanatus</i> | 15 % |
| Dandelion | | <i>Taraxacum officinale</i> Agg. | 1 % |
| White Clover | | <i>Trifolium repens</i> | <1 % |
| Structural Data | | | |
| Median Vegetation Height | | Vegetation Cover | |
| Graminoids | Forbs | Graminoids | Forbs |
| 10 cm | 4 cm | 95 % | 3 % |
| Bare Soil: 4 % | | | |

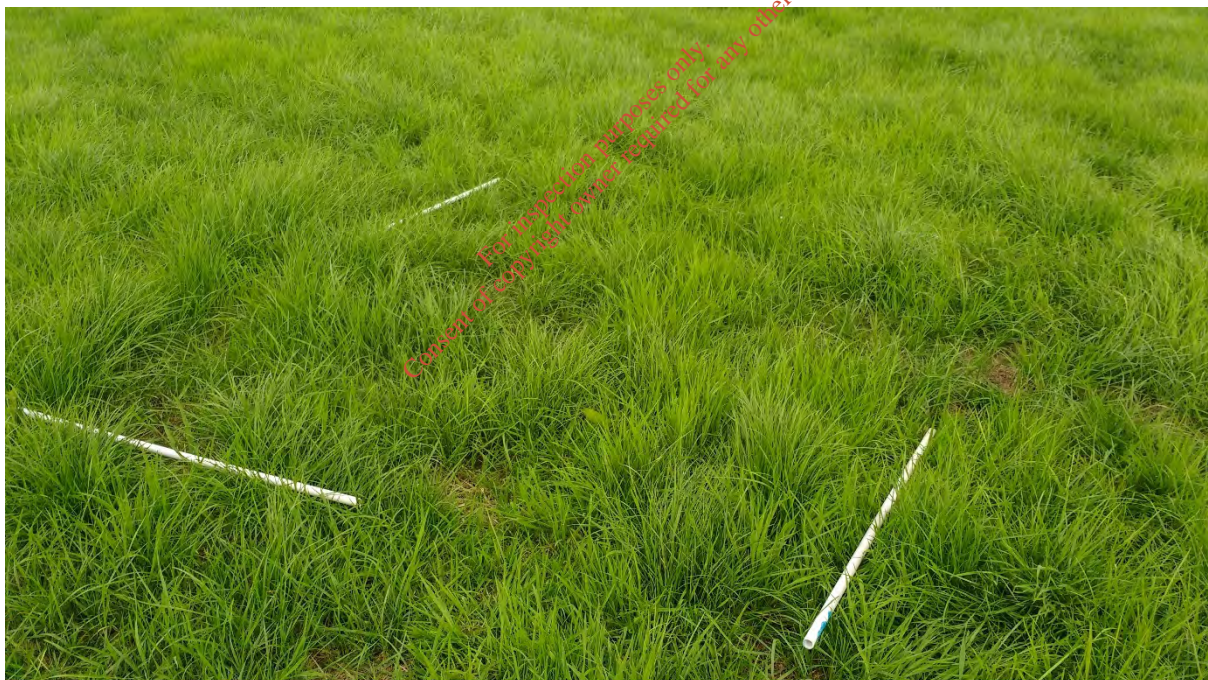


Plate 21: Q7

Table 12: Q8 (Quadrat 8)

| Species Composition & Cover | | | |
|-----------------------------|--------------------------|------------------|-------|
| Common Name | Scientific Name | Percentage Cover | |
| Yorkshire Fog | <i>Holcus lanatus</i> | 65 % | |
| Lesser Chickweed | <i>Stellaria pallida</i> | 1 % | |
| Thistle (seedling) | <i>Cirsium</i> Sp. | <1 % | |
| Structural Data | | | |
| Median Vegetation Height | | Vegetation Cover | |
| Graminoids | Forbs | Graminoids | Forbs |
| 12 cm | 2 cm | 65 % | 1 % |
| Bare Soil: 35 % | | | |



Plate 22: Q8

Table 13: Q9 (Quadrat 9)

| Species Composition & Cover | | | |
|-----------------------------|----------------------------------|------------------|-------|
| Common Name | Scientific Name | Percentage Cover | |
| Yorkshire Fog | <i>Holcus lanatus</i> | 90 % | |
| Perennial Rye-grass | <i>Lolium perenne</i> | 5 % | |
| Fescue | <i>Festuca</i> Sp. | 5 % | |
| Meadow Buttercup | <i>Ranunculus acris</i> | 5 % | |
| Creeping Buttercup | <i>Ranunculus repens</i> | 3 % | |
| Dandelion | <i>Taraxacum officinale</i> Agg. | 1 % | |
| White Clover | <i>Trifolium repens</i> | <1 % | |
| Lesser Chickweed | <i>Stellaria pallida</i> | <1 % | |
| Thistle (seedling) | <i>Cirsium</i> Sp. | <1 % | |
| Structural Data | | | |
| Median Vegetation Height | | Vegetation Cover | |
| Graminoids | Forbs | Graminoids | Forbs |
| 10 cm | 14 cm | 95 % | 8 % |
| Bare Soil: 5 % | | | |



Plate 23: Q9

Table 14: Q10 (Quadrat 10)

| Species Composition & Cover | | | |
|-----------------------------|-------|----------------------------------|------------------|
| Common Name | | Scientific Name | Percentage Cover |
| Yorkshire Fog | | <i>Holcus lanatus</i> | 85 % |
| Fescue | | <i>Festuca</i> Sp. | 10 % |
| Meadow Buttercup | | <i>Ranunculus acris</i> | 5 % |
| Creeping Buttercup | | <i>Ranunculus repens</i> | 3 % |
| Dandelion | | <i>Taraxacum officinale</i> Agg. | <1 % |
| Spear Thistle | | <i>Cirsium Vulgare</i> | <1 % |
| Broad-leaved Dock | | <i>Rumex obtusifolius</i> | <1 % |
| Capillary Thread-moss | | <i>Bryum capillare</i> | <1 % |
| Structural Data | | | |
| Median Vegetation Height | | Vegetation Cover | |
| Graminoids | Forbs | Graminoids | Forbs |
| 30 cm | 30 cm | 65 % | 6 % |
| Bare Soil: 10 % | | | |



Plate 24: Q10

Table 15: R1 (Relevé 1)

| Species Composition & Cover | | | |
|-----------------------------|-------|------------------------------|------------------|
| Common Name | | Scientific Name | Percentage Cover |
| Yorkshire Fog | | <i>Holcus lanatus</i> | 80 % |
| Creeping Bent-grass | | <i>Agrostis stolonifera</i> | 30 % |
| Bush Vetch | | <i>Vicia sepium</i> | 10 % |
| Red Clover | | <i>Trifolium pratense</i> | 5 % |
| Sweet Vernal Grass | | <i>Anthoxanthum odoratum</i> | 5 % |
| Ribwort plantain | | <i>Plantago lanceolata</i> | 5 % |
| Timothy-grass | | <i>Phleum pratense</i> | 3 % |
| Hop Trefoil | | <i>Trifolium campestre</i> | 2 % |
| Dandelion | | <i>Taraxacum officinale</i> | 1 % |
| Tufted Vetch | | <i>Vicia cracca</i> | <1 % |
| Lesser Stitchwort | | <i>Stellaria graminea</i> | <1 % |
| Common Ragwort | | <i>Jacobaea vulgaris</i> | <1 % |
| Structural Data | | | |
| Median Vegetation Height | | Vegetation Cover | |
| Graminoids | Forbs | Graminoids | Forbs |
| 50 cm | 30 cm | 80 % | 70 % |



Plate 25: R1

Table 16: R2 (Relevé 2)

| Species Composition & Cover | | | |
|-----------------------------|-------|---------------------------------|------------------|
| Common Name | | Scientific Name | Percentage Cover |
| Creeping Bent-grass | | <i>Agrostis stolonifera</i> | 70 % |
| Timothy-grass | | <i>Phleum pratense</i> | 15 % |
| Red Clover | | <i>Trifolium pratense</i> | 10 % |
| Yorkshire Fog | | <i>Holcus lanatus</i> | 10 % |
| Pointed Spear-moss | | <i>Calliergonella cuspidata</i> | 5 % |
| Perennial Rye-grass | | <i>Lolium perenne</i> | 1 % |
| Bush Vetch | | <i>Vicia sepium</i> | <1 % |
| Structural Data | | | |
| Median Vegetation Height | | Vegetation Cover | |
| Graminoids | Forbs | Graminoids | Forbs |
| 50 cm | 30 cm | 95 % | 10 % |



Plate 26: R2

Appendix 4

Woodland Botanical Survey Results

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Table 17: WR1 (Woodland Relevé 1)

| Species Composition & Cover | | |
|--|------------------------------------|-------------------------|
| Common Name | Scientific Name | Percentage Cover |
| Canopy | | |
| Ash | <i>Fraxinus excelsior</i> | 95 % |
| Alder | <i>Alnus glutinosa</i> | 5 % |
| Sycamore | <i>Acer pseudoplatanus</i> | 1 % |
| Field & Ground Layer | | |
| Smooth Meadow-grass | <i>Poa pratensis</i> | 95 % |
| Sheep's Fescue | <i>Festuca ovina</i> Agg. | 15 % |
| Remote Sedge | <i>Carex remota</i> | 2 % |
| Fox-tail Feather-moss | <i>Thamnobryum alopecurum</i> | 1.5 % |
| Common Feather-moss | <i>Kindbergia praelonga</i> | 1.5 % |
| Soft rush | <i>Juncus effusus</i> | <1 % |
| Mouse-tail Moss. | <i>Isoetecium myosuroides</i> | < 1 % |
| Short-leaved/Lesser Pocket-moss * | <i>Fissidens incurvus/bryoides</i> | < 1 % |
| Structural Data | | |
| Percentage Cover of Layers | | |
| Canopy | | 95 % |
| Shrub | | 0 % |
| Field/Ground | | 97 % |
| Bare Soil | | 3 % |
| Trunk Diameter at Breast Height | | |
| Range | | 17-46 cm |
| Average | | 30 cm |
| Stem Density | | |
| 3.6/m ² | | |
| Natural Regeneration | | |
| 21 Ash seedlings/young saplings (2.1/m ²) | | |
| Dead Wood | | |
| 1 x standing tree (20cm DBH); occasional twigs on ground | | |

* Capsules are required to differentiate these 2 species. More likely *F.bryoides* due to wider distribution in Ireland



Plate 27: WR1

Table 18: WR2 (Woodland Relevé 2)

| Species Composition & Cover | | |
|---|------------------------------------|------------------|
| Common Name | Scientific Name | Percentage Cover |
| Canopy | | |
| Ash | <i>Fraxinus excelsior</i> | 65 % |
| Alder | <i>Alnus glutinosa</i> | 30 % |
| Sycamore | <i>Acer pseudoplatanus</i> | 5 % |
| Shrub Layer | | |
| Bramble | <i>Rubus fruticosus</i> Agg. | 40 % |
| Field & Ground Layer | | |
| Smooth Meadow-grass | <i>Poa pratensis</i> | 40 % |
| Creeping Bent-grass | <i>Agrostis stolonifera</i> | 10 % |
| Soft rush | <i>Juncus effusus</i> | 5 % |
| Sheep's Fescue | <i>Festuca ovina</i> Agg. | 5 % |
| Timothy-grass | <i>Phleum pratense</i> | 2 % |
| Creeping buttercup | <i>Ranunculus acris</i> | 2 % |
| Fox-tail Feather-moss | <i>Thamnobryum alopecurum</i> | 1 % |
| Common Feather-moss | <i>Kindbergia praelonga</i> | < 1 % |
| Mouse-tail Moss. | <i>Isoetecium myosuroides</i> | < 1 % |
| Short-leaved/Lesser Pocket-moss * | <i>Fissidens incurvus/bryoides</i> | < 1 % |
| Rosebay Willowherb | <i>Chamaenerion angustifolium</i> | < 1 % |
| False Oat-grass | <i>Arrhenatherum elatius</i> | < 1 % |
| Short-fruited Willowherb | <i>Epilobium obscurum</i> | < 1 % |
| Structural Data | | |
| Percentage Cover of Layers | | |
| Canopy | | 85 % |
| Shrub | | 40 % |
| Field/Ground | | 59 % |
| Bare Soil | | 1 % |
| Trunk Diameter at Breast Height | | |
| Range | | 15-50 cm |
| Average | | 34 cm |
| Stem Density | | |
| 3.3/m ² | | |
| Natural Regeneration | | |
| 14 Ash seedlings/young saplings (1.4/m ²) | | |
| Dead Wood | | |
| None | | |



Plate 28: WR1

Table 19: WR3 (Woodland Relevé 3)

| Species Composition & Cover | | |
|--|----------------------------|------------------|
| Common Name | Scientific Name | Percentage Cover |
| Canopy | | |
| Sycamore | <i>Acer pseudoplatanus</i> | 21 % |
| Ash | <i>Fraxinus excelsior</i> | 7 % |
| Alder | <i>Alnus glutinosa</i> | 7 % |
| Field & Ground Layer | | |
| Yorkshire fog | <i>Holcus lanatus</i> | 65 % |
| Common Bent-grass | <i>Agrostis capillaris</i> | 33 % |
| Soft rush | <i>Juncus effusus</i> | 1 % |
| Common Couch-grass | <i>Elymus repens</i> | < 1 % |
| Timothy-grass | <i>Phleum pratense</i> | < 1 % |
| Great Willowherb | <i>Epilobium hirsutum</i> | < 1 % |
| Structural Data | | |
| Percentage Cover of Layers | | |
| Canopy | | 35 % |
| Shrub | | 0 % |
| Field/Ground | | 100 % |
| Bare Soil | | 0 % |
| Trunk Diameter at Breast Height | | |
| Range | | 7-28 cm |
| Average | | 20 cm |
| Stem Density | | |
| | | 3/m ² |
| Natural Regeneration | | |
| | | None |
| Dead Wood | | |
| | | None |



Plate 29: WR3

Table 20: WR4 (Woodland Relevé 4)

| Species Composition & Cover | | |
|--|------------------------------------|-------------------------|
| Common Name | Scientific Name | Percentage Cover |
| Canopy | | |
| Alder | <i>Alnus glutinosa</i> | 70 % |
| Sycamore | <i>Acer pseudoplatanus</i> | 20 % |
| Ash | <i>Fraxinus excelsior</i> | 15 % |
| Shrub Layer | | |
| Bramble | <i>Rubus fruticosus</i> Agg. | 10 % |
| Field & Ground Layer | | |
| False Oat-grass | <i>Arrhenatherum elatius</i> | 70 % |
| Sheep's Fescue | <i>Festuca ovina</i> Agg. | 10 % |
| Fox-tail Feather-moss | <i>Thamnobryum alopecurum</i> | 7 % |
| Dandelion | <i>Taraxacum officinale</i> Agg. | 5 % |
| Great Willowherb | <i>Epilobium hirsutum</i> | 1 % |
| Remote Sedge | <i>Carex remota</i> | <1 % |
| Soft rush | <i>Juncus effusus</i> | 1 % |
| Creeping cinquefoil | <i>Potentilla reptans</i> | <1 % |
| Short-leaved/Lesser Pocket-moss * | <i>Fissidens incurvus/bryoides</i> | < 1 % |
| Common Feather-moss | <i>Kindbergia praelonga</i> | < 1 % |
| Mouse-tail Moss. | <i>Isoetecium myosuroides</i> | < 1 % |
| Structural Data | | |
| Percentage Cover of Layers | | |
| Canopy | | 80 % |
| Shrub | | 10 % |
| Field/Ground | | 85 % |
| Bare Soil | | 5 % |
| Trunk Diameter at Breast Height | | |
| Range | | 7-44 cm |
| Average | | 35 cm |
| Stem Density | | |
| 3.4/m ² | | |
| Natural Regeneration | | |
| 1 Ash seedlings/young saplings (0.1/m ²) | | |
| Dead Wood | | |
| Occasional twigs on ground | | |



Plate 30: WR4

Appendix 5

Additional Photographs

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Plate 31: Broadleaved Woodland WD1



Plate 32: Mixed Broadleaved/Conifer Woodland WD2



Plate 33: Scrub WS1



Plate 34: Treelines WL2



Plate 35: Artificial Lakes and Ponds FL8

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