



The National Arterial Drainage Maintenance List of Activities 2016-2021

Volume III

Natura Impact Statement

February 2016

Office of Public Work
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Co. Galway



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This report describes work commissioned by the Office of Public Work (OPW), by a letter dated 27/01/2016. The OPW's representative for the contract was Nathy Gilligan. Anne Murray, Niamh Sweeney, Tanya Slattery and Catalina Herrera of JBA Consulting carried out this work.

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Purpose

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Abbreviations

AA	Appropriate Assessment
CFRAM	Catchment Flood Risk Assessment and Management
DEHLG	Department of Environment, Heritage and Local Government
EC	European Communities
FRM	Flood Risk Management
FRMP	Flood Risk Management Plan
IFI	Inland Fisheries Ireland
IROPI	Imperative Reasons of Over-riding Public Interest
NPWS	National Parks and Wildlife Service
RBD	River Basin District
SAC	Special Area of Conservation
SEA	Strategic Environmental Assessment
SPA	Special Protection Area
WFD	Water Framework Directive

1 Introduction

The OPW is the authority in Ireland with the statutory responsibility for arterial drainage maintenance and flood relief works. The Arterial Drainage Act, 1945 empowered the OPW to construct and maintain arterial drainage schemes around the country. The current programme is the Arterial Drainage Maintenance Activities (2016-2021). The Flood Relief Schemes maintained by the County Councils are not covered by the OPW Arterial Drainage Maintenance Activities (2016-2021).

In Ireland, and on foot of the 2004 EU Directive, there is a requirement of a Strategic Environmental Assessment (SEA) and Appropriate Assessment (AA) for National Plans and Programmes. The purpose of the SEA is to carry out a systematic assessment of the Plan or the Programme on the environment before the Plan or Programme is adopted. The Arterial Drainage Maintenance Activities (2016-2021) is subject to a SEA.

This Natura Impact Statement forms output for the Appropriate Assessment (AA) which accompanies the Environmental Report for the Strategic Environmental Assessment (SEA) of the National Arterial Drainage Maintenance Activities (2016-2021). This report identifies the significant environmental effects of the proposed maintenance activities on Natura 2000 sites and where significant impacts have been identified, the report outlines appropriate mitigation measures to reduce these potential impacts. Where inadequacies or gaps in current procedures and approaches to environmental aspects of the proposed programme are noted, recommendations are provided to address these.

There are many Natura 2000 sites, designated under the EU Birds Directive (2009/147/EC) and Habitat Directive (92/43/EEC) are located within the zone of influence of the Arterial Drainage Maintenance Activities (2016-2021).

A Screening for Appropriate Assessment Report provides the information for those Natura 2000 sites that are screened in, that may be significantly impacted by the Arterial Drainage Maintenance Activities (2016-2021) and/or Natura 2000 sites, where uncertainty arose regarding the potential for impact, and require further assessment in the next stage of the AA process, Stage 2 AA. The outcome of the screening process is outlined in Section 3.4 of this report. A stage 2 AA is required to assess the potential significant impacts of the maintenance activities on the Natura 2000 sites and to provide mitigation measures aimed at addressing these. The Natura Impact Statement (NIS) in Section **Error! Reference source not found.** provides the information required for the Stage 2 A A.

This report was conducted and prepared by JBA Consultants Ltd. Grove Island, Corbally, Co. Limerick. JBA Consultants Ltd. will be referred to hereafter as JBA in this report.

1.1 Legislative Context

The Habitats Directive (Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora) aims to maintain or restore the favourable conservation status of habitats and species of community interest across Europe.

The requirements of Articles 6(3) and 6(4) of the Habitats Directive have been transposed into Irish legislation by means of the Habitats Regulations, 1997 (S.I. No. 94 of 1997) and the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 / 2011).

Under the Directive a network of sites of nature conservation importance have been identified by each Member State as containing specified habitats or species requiring to be maintained or returned to favourable conservation status. In Ireland, the network consists of Special Areas of Conservation (SACs) and Special Protection Areas (SPAs), and also candidate sites, which form the Natura 2000 network.

Article 6(3) of the Habitats Directive requires that, in relation to European designated sites (i.e. SACs and SPAs that form the Natura 2000 network), *"any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives"*.

A competent authority (e.g. Local Authority) can only agree to a plan or project after having determined that it will not adversely affect the integrity of the site concerned.

Under article 6(4) of the Directive, if adverse impacts are likely, and in the absence of alternative options, a plan or project must nevertheless proceed for imperative reasons of overriding public interest (IROPI), including social or economic reasons, a Member State is required to take all compensatory measures necessary to ensure the overall integrity of the Natura 2000 site. The European Commission have to be informed of any compensatory measures adopted, unless a priority habitat type or species is present and in which case an opinion from the European Commission is required beforehand (unless for human health or public safety reasons, or of benefit to the environment).

The Planning and Development Act 2000, and amendments, consolidates all planning legislation from 1963 to 1999 and is the basis for the Irish planning code, setting out the detail of regional planning guidelines, development plans and local area plans as well as the basic framework of the development management and consent system. The Act sets out the requirement of a Natura Impact Statement for a plan, to meet the requirements of article 6(3) of the Habitats Directive, the consideration of in-combination effects and classify any implications in view of the conservation objectives of Natura 2000 sites.

1.2 Appropriate Assessment Process

Guidance on the Appropriate Assessment (AA) process was produced by the European Commission in 2002, which was subsequently developed into guidance specifically for Ireland by the Department of Environment, Heritage and Local Government (DEHLG) (2009). These guidance documents identify a staged approach to conducting an AA, as shown Figure 1-1.

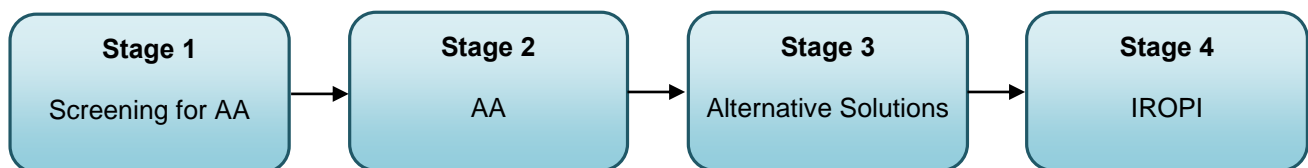


Figure 1-1: The Appropriate Assessment Process (from: Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities, DEHLG, 2009)

1.2.1 Stage 1 - Screening for AA

The initial, screening stage of the Appropriate Assessment is to determine:

- whether the proposed plan or project is directly connected with or necessary for the management of the European designated site for nature conservation
- if it is likely to have a significant adverse effect on the European designated site, either individually or in combination with other plans or projects

For those sites where potential adverse impacts are identified, either alone or in combination with other plans or projects, further assessment is necessary to determine if the proposals will have an adverse impact on the integrity of a European designated site, in view of the sites conservation objectives (i.e. the process proceeds to Stage 2).

1.2.2 Stage 2 - AA

This stage requires a more in-depth evaluation of the plan or project, and the potential direct and indirect impacts of them on the integrity and interest features of the European designated site(s), alone and in-combination with other plans and projects, taking into account the site's structure, function and conservation objectives. Where required, mitigation or avoidance measures will be suggested.

The competent authority can only agree to the plan or project after having ascertained that it will not adversely affect the integrity of the site(s) concerned. If this cannot be determined, and where mitigation cannot be achieved, then alternative solutions will need to be considered (i.e. the process proceeds to Stage 3).

1.2.3 Stage 3 - Alternative Solutions

Where adverse impacts on the integrity of Natura 2000 sites are identified, and mitigation cannot be satisfactorily implemented, alternative ways of achieving the objectives of the plan or project that avoid adverse impacts need to be considered. If none can be found, the process proceeds to Stage 4.

1.2.4 Stage 4 - IROPI

Where adverse impacts of a plan or project on the integrity of Natura 2000 sites are identified and no alternative solutions exist, the plan will only be allowed to progress if imperative reasons of overriding public interest (IROPI) can be demonstrated. In this case compensatory measures will be required.

The process only proceeds through each of the four stages for certain plans or projects. For example, for a plan or project, not connected with management of a site, but where no likely significant impacts are identified, the process stops at stage 1. Throughout the process, the precautionary principle must be applied, so that any uncertainties do not result in adverse impacts on a site.

1.3 Methodology

The Screening for Appropriate Assessment Report and the Natura Impact Statement have been prepared with regard to the following documents:

- DoEHLG (2009 rev 2010) Appropriate Assessment of Plans and Projects in Ireland Guidance for Planning Authorities. Department of the Environment, Heritage and Local Government.
- European Communities (EC) (2000) Managing Natura 2000 Sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC, Office for Official Publications of the European Communities, Luxembourg. European Commission.
- EC (2002) Assessment of Plans and Projects Significantly Affecting Natura 2000 Sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC, Office for Official Publications of the European Communities, Luxembourg. European Commission.
- EC (2007) Guidance document on Article 6(4) of the 'Habitats Directive' 92/43/EEC – Clarification of the concepts of: alternative solutions, imperative reasons of overriding public interest, compensatory measures, overall coherence, opinion of the commission. European Commission.
- EC (2007) Interpretation Manual of European Union Habitats. Version EUR 27. European Commission.
- National Parks and Wildlife Service (NPWS) (2008). The Status of EU Protected Habitats and Species in Ireland. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.
- NPWS (2014). The Status of EU Protected Habitats and Species in Ireland. Habitats Assessment Volume 2. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.
- NPWS (2014). The Status of EU Protected Habitats and Species in Ireland. Species Assessment Volume 3. Habitats Assessment Volume 2. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.

2 Programme Description

2.1 Introduction

Where the commissioner of Public Works has completed a drainage scheme under the Arterial Drainage Act, 1945 and 1995, it becomes the statutory requirement of the OPW to maintain the drainage works forming part of the Scheme.

The annual drainage maintenance programmes are compiled for each scheme to maintain the drainage network or flood relief scheme structures. Every year approximately one-fifth of all the watercourses are maintained, which are prioritised based on the potential flood risk posed to the surrounding areas. The Arterial Drainage Maintenance activities also contains a national 5-year schedule of Appropriate Assessment for Schemes as displayed in Figure 2-1 below.

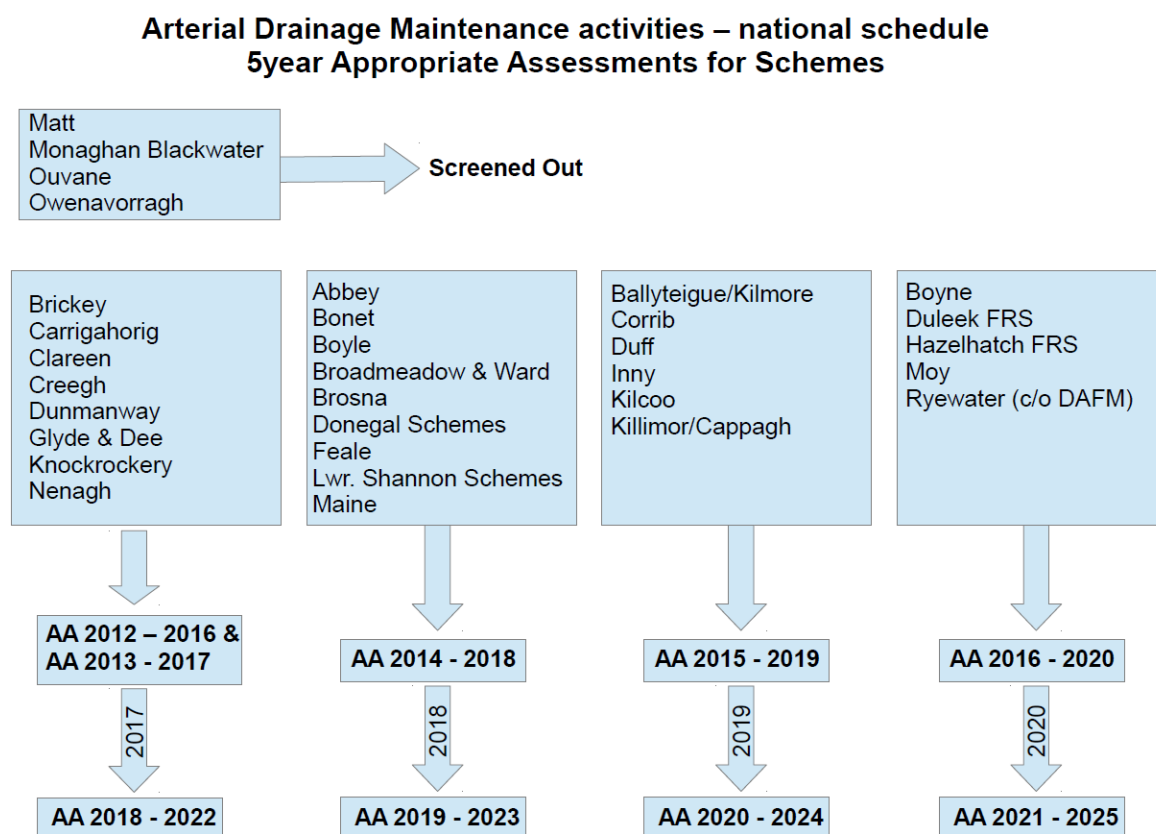


Figure 2-1. Arterial Drainage Maintenance Activities-National Schedule 5-Year Appropriate Assessment for Schemes.

The key points of the draft National Arterial Drainage Activities (2016-2021) are summarised in the remainder of this section.

2.1.1 The Arterial Drainage Schemes

The OPW is the authority which has the statutory responsibility for river drainage and flood relief works. The scope of the Arterial Drainage Maintenance Activities (2016-2021) covers all of the schemes listed in Table 2-1 and displayed in Figure 2-2. The Flood Relief Schemes maintained by other Local Authorities and are not subject to OPW Arterial Drainage Maintenance Activities (2016-2021) are listed in Table 2-2.

Table 2-1: OPW Schemes carried out under Arterial Drainage Acts 1945 and 1995

Scheme	Duration of Works	Areas Benefiting (hectares)
Major Schemes (River Catchments over 100,000 acres in extent)		
Brosna	1948-1955	34883
Glyde & Dee	1950-1957	10643
Feale	1951-1959	10724
Corrib-Clare	1951-1959	10724
Maine	1954-1964	30310
Inny	1959-1963	4694
Deel	1962-1968	20234
Moy	1960-1971	4816
Corrib-Headford	1967-1973	24685
Boyne	1969-1986	48157
Maigue	1973-1986	12343
Corrib-Mask	1979-1986	9712
Boyle	1982-1992	10845
Blackwater (Monaghan)	1984-1992	2367
Minor Schemes (River Catchment 25,000-1000,000 acres)		
Nenagh	1955-1960	2630
Ballyteige/Kilmore	1959-1961	931
Broadmeadow & Ward	1961-1964	2995
Killimor/Cappagh	1962-1968	5099
Bonet	1982-1992	1295
Other Small Schemes (River Catchment less than 25,000 acres)		
Clareen	1959-1961	445
Ouvane	1962-1963	162
Matt	1964-1965	202
Duff	1963-1965	1457
Brickey	1965-1967	405
Abbey	1964-1967	364
Knockcroghery	1967-1968	202
Creegh	1968-1969	405
Burnfoot/Skeoge	1968-1970	162
Kilcoo	1969-1971	162
Owenavorrigh	1968-1970	1052
Carrigahorig	1968-1971	1538
Groody	1970-1973	1214
Deel and Swillyburn	1957-1961	1416
Cloonburn	1967-1968	162
Estuarine Embankment Schemes		
Shannon (Limerick)	1962-1971	4897
Shannon (Clare)	1958-1960	728
Fergus	1959-1960	728
Owenogarney	1955-1959	850
Swilly	1961-1968	1295
Flood Relief Schemes		Year Completed
Belclare, Clare River maintained as part of the Corrib-Headford Drainage Scheme		1995

Gort Town, Co. Galway maintained as part of the Gort Flood Relief Scheme	1997
Sixmilebridge, Co. Clare maintained as part of the Owengarney Catchment Drainage Scheme	1997
Lacken (Ardrahan), Co. Galway maintained as part of the Lacken Drainage Scheme.	1997
Nanny River, Duleek, Co. Meath maintained as part of the Nanny Scheme.	1998
Mulkear River, Newport, Co. Tipperary maintained as part of the Mulkear River Scheme	1998
Ballymakeogh, Co. Tipperary maintained as part of the Scheme	1998
Mulkear River, Cappaghmore, Co. Limerick maintained as part of the Scheme	2000
Bridge End, Co. Donegal , improvement to the Skeoge Scheme and is maintained as part of the Scheme.	2000
Bandon River, Dunmanway, Co. Cork , this is maintained as part of the Scheme.	2001
Shinkeen Stream, Hazelhatch, Co. Kildare , this is maintained as part of the Scheme.	2001
Maam Valley, Co. Galway ; this was an improvement to the Scheme, and is maintained as part of the Scheme.	2001
Suir River, Carrick-on-Suir, Co. Tipperary ; this is maintained as part of the Scheme.	2003
Nore River, Kilkenny ; This is maintained as part of the Scheme	2006
Ennis, Co. Clare , maintained by the OPW but the maintenance of the pumps is through SLA with the County Council.	2013
Mornington, Co. Meath , maintained as part of the Mornington Scheme	2012
Tullamore, Co. Offaly , this is maintained as part of the Scheme.	2013
Clonmel, Co. Tipperary maintained by the OPW, however maintenance pumps is through SLA and the County Councils.	2014
Fermoy, Co. Cork maintained by the OPW, however maintenance pumps is through SLA and the County Councils.	2015
Mallow, Co. Cork maintained by the OPW, however maintenance pumps is through SLA and the County Councils.	2016

Table 2-2: Flood Relief Schemes not maintained by the OPW as part of the Arterial Drainage Maintenance Activities 2016-2021

Flood Relief Scheme	Maintained by	Year Completed
Dromcollogher, Co. Limerick	County Councils	2000
Morrell River, Maynooth, Co. Kildare	County Council	2003
Leixlip, Co. Kildare	County Council	2009
Ennis, Co. Clare	Channel and embankments by OPW, pumps by County Council through service level agreement.	2013
Carlow, Co. Carlow	County Council	2013
Johnstown, Co. Meath	County Council	2012
Clonmel, Co. Tipperary	Channel and embankments by OPW, pumps by County Council through service level agreement.	2014
Fermoy, Co. Cork	Channel and embankments by OPW, pumps by County Council through service level agreement.	2015
Mallow, Co. Cork	Channel and embankments by OPW, pumps by County Council through service level agreement.	2016

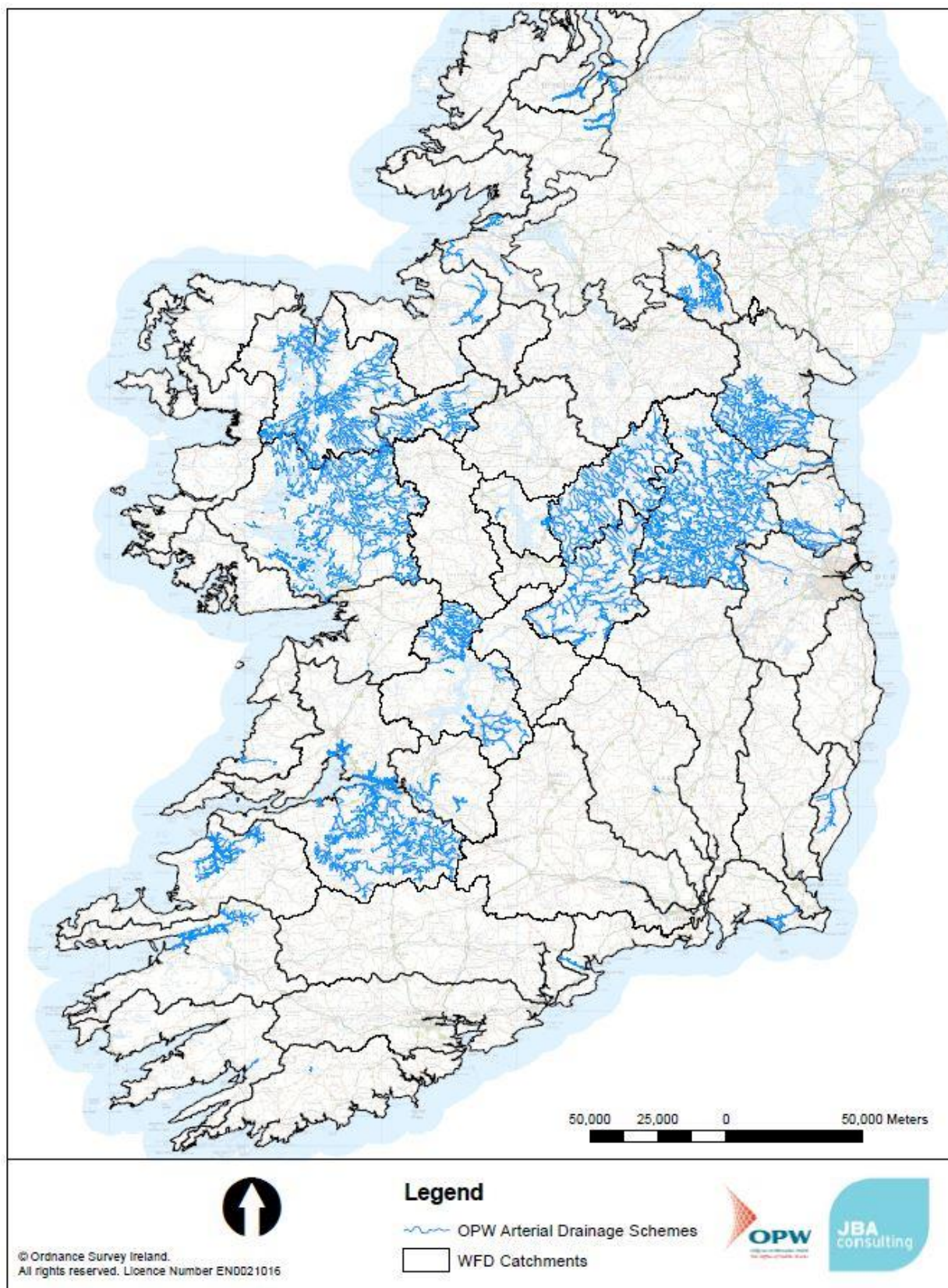


Figure 2-2: Arterial Drainage Channels/ Embankments/ Flood Relief Schemes maintained by the OPW

2.2 Arterial Drainage Maintenance

2.2.1 The Arterial Drainage Schemes

The OPW is the authority which exercises the statutory responsibility in respect to arterial drainage and flood relief works. The scope of the Arterial Drainage Maintenance Activities (2016-2021) covers all of the OPW Arterial Drainage Schemes (channel, embankment, flood relief schemes) listed above.

2.2.2 List of Activities

The National Arterial Drainage Maintenance 2016-2021 activities include:

- Channel Maintenance Activities
- Embankment Maintenance Activities
- Structural Maintenance Activities
- Flood Relief Scheme Maintenance Activities

The OPW is responsible for the maintenance of 11,500 km of channel, 730 km of embankments, some 18,500 bridges and 750 ancillary structures such as sluice gates and pumping stations.

The majority of Arterial Drainage Maintenance works is on channel maintenance with an average channel requiring maintenance every four to six years. Some channels may require annual maintenance and others only require maintenance once every twenty years.

Channel Maintenance 2016-2021

Channel Maintenance is required on average every four to six years. Channels with prolific vegetation growth may require maintenance every year, while channels with self-cleaning characteristics may only need maintenance every 20 years. The activities involve the following:

- Removal of water-entrained silt and associated vegetation from the bed of the channel by hydraulic excavators
- Bank protection work involving re-profiling the bank in-situ or importing protection material such as rock armour or log poles in case of channel breaches due to erosion.
- Trimming or removal of trees or branches that may be impinging on channel.
- Aquatic Vegetation Cutting: For wide channels weed-cutting boats are used.

When developing annual maintenance programmes, the OPW give consideration to impacts on fisheries, protected habitats and species, nationally designated sites and Natura 2000 Sites, through the consultation of an ecological consultant and consultation with Inland Fisheries Ireland and National Parks and Wildlife Services.

Embankment Activities 2016-2021

The OPW introduced a programme of embankment strengthening to reverse the damage which resulted from limited monitoring and increased deteriorating conditions of embankments. The programming of works consists of inspections of sections of embankments known to be at high risk. Repair works consist of topping up clay embankments to design height and structural strengthening by importing rock/soil material or utilising in-situ material. The works are carried out by direct labour or contract.

Structural Maintenance Activities 2016-2021

Around 18,500 bridges provide farmers with farm vehicular or foot access across Arterial Drainage Scheme Channels. Inspections are carried out to assess necessity of repair or replacement of structures. Approximately 170 bridges are repaired/replaced annually. Other structures such as gates, barrages, and pumping stations are also maintained or repaired.

Flood Relief Scheme Maintenance Activities 2016-2021

All Flood Relief Schemes have a statutory maintenance requirement. The need for maintenance is identified at a regional level on an annual basis. Activities vary depending on the characterisation of the Scheme, durable structural works may require minimum maintenance, and however other schemes may require continued maintenance. Activities may vary, and include:

- Periodical silt removal
- Riparian vegetation management
- Maintenance of designed channel capacity

Programme Exclusion

The National Arterial Drainage Maintenance Activities 2016-2021 activities does not include maintenance of the following:

- Newly (i.e. still in construction or planning stage) constructed Arterial Drainage Schemes
- Catchment Flood Risk Assessment & Management Study proposals or recommendations (CFRAM)
- New Flood Relief Schemes, which entail public exhibition and Ministerial Approval.
- Drainage Districts that are the responsibility of Local Authorities

2.3 Environmental Management and Maintenance Planning

All maintenance operations are carried out in accordance with OPWs Environmental Management Protocols and Standard Operating Procedures (SOP).

The maintenance function of the OPW is divided into three regions for the purpose of programming and executing the work. The East Region main office is in Newtown, Trim, Co. Meath with four sub-offices in Ardee, Monaghan, Mullingar and Wexford. The South West region main office is in Templemungret, Co. Limerick with two sub-offices in Listowel and Portumna. The West region main office is in Headford, Co. Galway with two sub-offices in Ballina and Lifford.

Every year, each Arterial Drainage Maintenance Region produces a draft Annual Drainage Maintenance Programme for the upcoming year. The proposed works are indicated for each channel under the headings A-F:

- A-Silt and vegetation management
- B-Aquatic Vegetation Cutting
- C-Bank Protection
- D-Bush Cutting Branch Trimming
- E- Tree Cutting
- F- Bridge/ Structure Repairs

The OPW Environmental Section reviews the draft programme for the upcoming years including timing, season, month, and duration of the works.

The frequency of maintenance is usually driven by a 5-year cycle or specific landowner requests. Prior to maintenance activity, the site foreman and machine operators walk the reach to be maintained and review health and safety aspects and the 10 - point Environmental Drainage Maintenance (EDM) Guidelines (see below, Section 3.4). The operators and foremen are provided with maps and details of the information in the OPWs drainage maintenance species and habitats layers. It is the decision of the driver how to undertake the maintenance using established maintenance access corridors or whether further access to the watercourse or embankments are required.

Communication with stakeholders

The draft Regional Arterial Drainage Maintenance Programmes are forwarded to the Inland Fisheries Ireland (IFI) Environmental River Enhancement Programme (EREP) project manager who reviews the programme for appropriate sites and study locations for EREP projects.

The Arterial Drainage Maintenance Region forwards the relevant sections of its final Annual Drainage Maintenance Programme for the upcoming year with a copy of appropriate scheme maps, to the National Parks and Wildlife Services (NPWS) Regional Managers and the IFI Directors.

Consultation should also include National Monument Service (NMS) at the Department of Arts, Heritage, Regional, Rural, and Gaeltacht Affairs (DAHRRGA)

The Arterial Drainage Maintenance Regions offer the opportunity for a meeting with stakeholders to discuss the Annual Drainage Maintenance Programme.

Environmental River Enhancement Programme (EREP)

Sites identified for river enhancement projects will be subject to hydromorphological surveys to ensure the enhancements are technically feasible, along with other screening processes (i.e. Water Framework Directive Programme of Measures under the requirements for morphology). Some sites will be prioritised on the basis of best return for investment. In all cases, Inland Fisheries Ireland (IFI) is the statutory authority to give design guidance to the OPW. Angling Clubs or other sectoral funding source can liaise with IFI authorities in respect to the design and environmental monitoring requirements.

As part of EREP projects, team members are required to carry out walkover surveys as an opportunity to discuss in detail on site the potential options for river enhancement. In attendance are members of IFI and OPW regional staff. Table 2-3 and Figure 2-3 below detail EREP Schemes per catchment.

Table 2-3: EREP Capital Projects Completed by Catchment

Catchment	OPW Schemes	No. of EREP Projects
Lough Neagh & Lower Bann	Monaghan Blackwater	1
Newry, Fane, Glyde and Dee	Glyde and Dee	3
Boyne	Boyne	6
Liffey and Dublin Bay	Ryewater and Hazelhatch (Shinkeen), Leixlip (Kildare)	1
Laune-Maine-Dingle Bay	Maine	4
Shannon Estuary South	Deel, Mague, Shannon Embankment South, Mague outfall	8
Lower Shannon (A)	Brosna	1
Lower Shannon (C)	Clareen, Nenagh, Woodford, Killmor and Carrigahorig	4
Upper Shannon (F)	Inny	3
Corrib	Corrib	16
Moy and Killala Bay	Moy	9
Erne	Abbey, Duff and Kilcoo	2

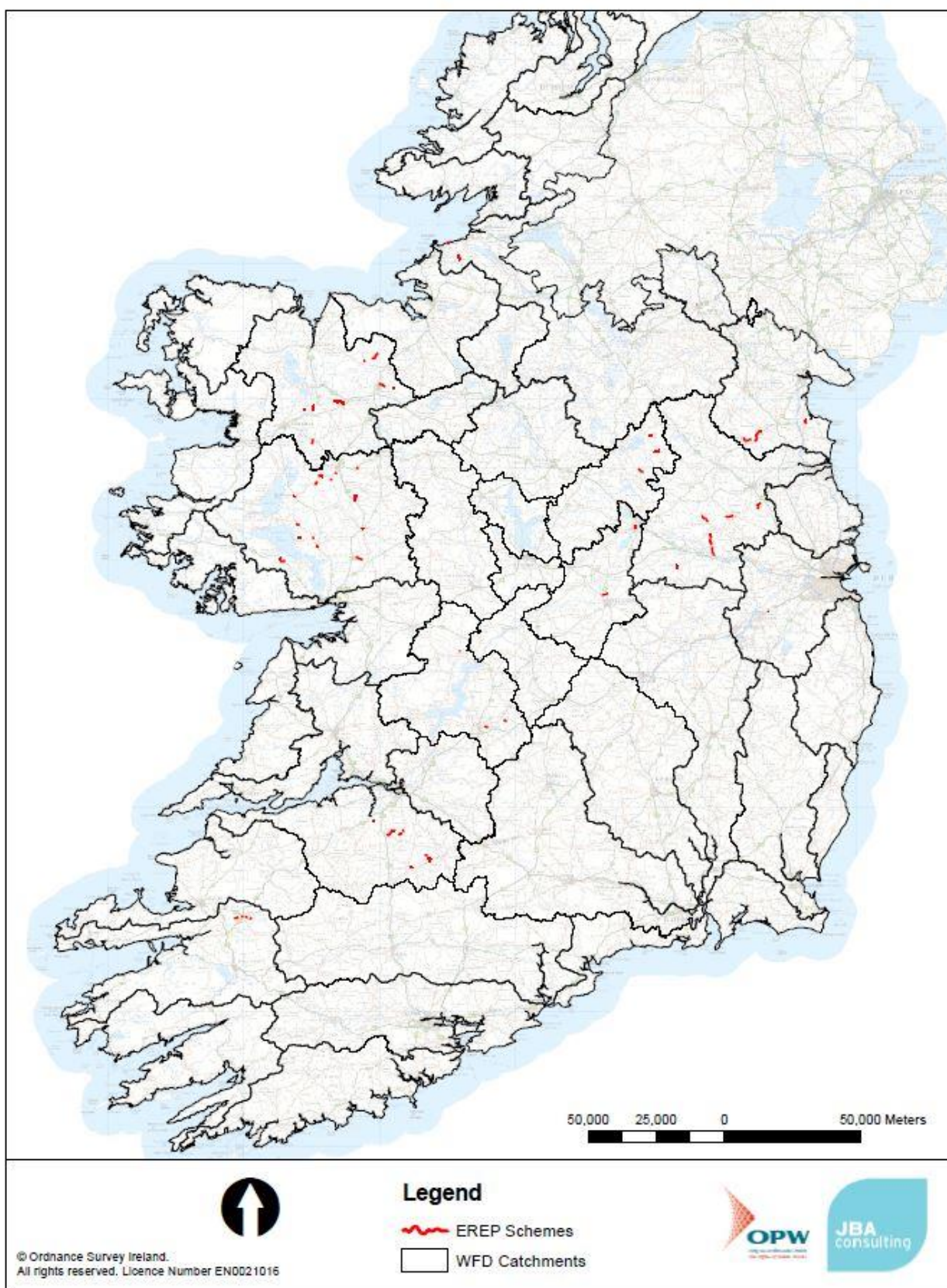


Figure 2-3: EREP Schemes per catchment

2.4 OPW Standard Operating Procedures (SOP)

There is a total of seven SOPs that are applied during the operational works (See Appendix A and <http://www.opw.ie/en/floodriskmanagement/operations/environmentalactivities/>);

- Environmental Drainage Guidance Notes (10 steps to Environmentally Friendly Maintenance)
- Lamprey SOP
- Crayfish SOP
- Otter SOP
- Mussel SOP
- Invasive Species SOP
- Zebra Mussel SOP

Environmental Drainage Maintenance (EDM) Guidelines

Operational crews are audited annually for implementation of the EDM guidelines and environmental operating procedures (SOPs). The auditing is carried out separately by both IFI and OPW Environment Section on a rotational basis to ensure all operational crews are audited at least once every three years. These can be found online here: <http://www.opw.ie/en/floodriskmanagement/operations/environmentalactivities/>.

The OPW and IFI, summarised the Environmental Strategies for Channel Maintenance into the following 10 steps:

1. Protecting bank slope
2. Confining works to channel centre
3. Spoil Management
4. Vegetation Management
5. Skipping sections
6. Tree Management
7. Berm Management
8. Replacing stone and boulders back in the channel
9. Gravel bed channels
10. New excavations in the channel

There are also additional mitigation measures recommended for different stages of maintenance works. These include skipping sections of the channel in order to retain intact habitat, avoidance of secondary disturbance downstream, proposal of longer periods between maintenance, timing maintenance to accommodate spawning or breeding seasons, among others.

Some examples of the Environmental Drainage Maintenance Guidelines contained in the current version of OPW's SOPs are outlined below.

Salmonids

Maintenance of the channel must be in accordance with Salmon and Trout Spawning Season. The location of the works must accommodate spawning areas. Activities on spawning beds are carried out from July to September. Prior to works, the local IFI must be consulted. River enhancement works to improve fisheries and broader ecology are covered under the EREP programme.

Lamprey

The presence of Lamprey must be checked against the OPW GIS database before any in-channel work takes place. If Lamprey are encountered, several members of staff should be notified (Foreman, Engineer) and the location and abundance of Lamprey should be noted in a **Weekly Record Card**. In order to reduce potential impacts three approaches are suggested such as skip a defined stretch of channel, confine maintenance to 2/3 of the channel in order to retain marginal vegetation and silt intact, and maximise the use of weed cutting buckets.

Crayfish

The presence of Crayfish must be checked against the OPW GIS database before any in-channel work takes place. If Crayfish are encountered, several members of staff should be notified (Foreman, Engineer) and the location and abundance of Crayfish should be noted in a Weekly Record Card. In order to reduce potential impacts, three approaches are suggested: skip a defined stretch of channel, confine maintenance to 2/3 of the channel in order to retain marginal vegetation and silt intact, and maximise the use of weed cutting buckets.

Otter

Otters are widespread across all sizes of drainage channels nationally. Operational staff should walkover the site one week before the maintenance commences. Dense areas with access directly to water should be noted and avoided where feasible. Any recognisable signs of otter presence observed such as spraints, footprints, or suspected Holts will be recorded on the Weekly Record Cards. There should also be no maintenance activities within a 50m buffer each side of an otter holt.

Freshwater Pearl Mussel (FPM)

According to NPWS, there are 91 known FPM populations in Ireland, nine of which are OPW channels. There are no in-stream works allowed in an area recognised as a FPM habitat, typically only non in-stream works adjacent to the channel are permissible under OPW's working procedures. Simple activities require special precaution in order to minimise channel bed disturbance. The need for silt management procedures must be assessed for works upstream of the FPM habitat before their commencement.

Kingfisher

In areas known to hold populations of Kingfishers, the mitigation measures include avoiding nesting areas, and visual sighting of kingfisher must be recorded on Weekly Report Cards. All sightings must be recorded on the Record Database in accordance with the National Recording Process.

Birds

The removal of any abnormally dense layer of vegetation is to be executed between September and February to minimise impacts on nesting birds. If the channel is located within a Natura 2000 site containing valuable over-wintering bird populations, consultation with the NPWS must be undertaken to determine the timing and phasing of the works to limit disturbance.

Bats

In the case that the removal of a large tree is necessary for the maintenance works, regard is given to the likelihood of bat roosting habitat, and these trees are left in their fallen position for 24hrs to allow any bats to vacate. For structural works, the works are assessed for their impacts on bats and a bat specialist is contracted to survey for bat presence before the works commence, to avoid entombment of any bats.

Invasive Species

Multiple invasive species are spread nationally and it can be assumed that one or more of these are present on any work sites. The most common species of invasive plants include Japanese Knotweed, Giant Hogweed, and Himalayan Balsam. The OPW does not have any direct responsibility for the management of invasive species. However, in order to ensure OPW operations are not a vector for these invasive, measures are required to reduce the risk of spreading. The OPW SOPs for invasive species are found in Appendix A.

Zebra mussels are present in various locations around Ireland such as the River Shannon, Grand Canal, L. Derg, L. Ree, L. Garra, L. Derravaragh, L. Sheelin, L. Corrib, L. Conn, L. Arrow, the River Glyde catchment, among others. Due to the quick spread of the species, any proposed work close to a river or lake that has potential to contain Zebra mussels must be flagged and staff should pay special attention to cleaning procedures for all equipment, prior to removal from site.

Wetlands - Bogs, Fenlands and Turloughs

All channels located within an SAC must be checked against the list of channels that impinge on Raised Bogs, Fen habitats, Turloughs and have regard to any NPWS agreements. In the case where impact is likely, it is necessary to conduct a site visit in consultation with NPWS to determine mitigation measures, such as: skipping channel in questions, while recognising the drainage and flood risk management requirements, maximising use of weed bucket, and inspection by OPW line

management to determine the likelihood of over-digging the channel below the original design datum.

Tree Management

Site with dense tree cover may require maintenance for conveyance or fisheries purposes. Removal of dense layers or vegetation can only be executed between September and February, to minimise disturbance on nesting birds. In order to facilitate IFI's request, OPW management staff and IFI officer carry out a site visit, where they propose a selective approach to tree removal, which maintains a dappling of shade along the channel.

2.5 Mitigation and Monitoring

2.5.1 Environmental Management System

All of the maintenance works carried out as part of this programme are guided by the OPWs Environmental Management Protocols and SOPs. There are various approaches taken by the OPW to promote environmental management such as the introduction of EREP and the provision of ongoing environmental training to staff. The most recent formal environmental training took place in 2010 and focused on the most recent environmental practices at the time. In addition, in 2008, the operational staff received a training course in Otter Awareness.

Geographic Information Systems (GIS) are a significant tool to manage both existing and future environmental data, which allows for a rapid and accurate transfer of geographical environmental information.

The Arterial Drainage Programme is screened for potential impacts on Natura 2000 sites. If channels are identified as having the potential to impact on a Natura 2000 site, it is subject to Appropriate Assessment under Article 6(3) of the Habitats Directive. A national framework has been set up where Arterial Drainage Maintenance activities undergo an Appropriate Assessment for a 5-year period. Each scheme undergoes an AA and all prescribed mitigation measures are disclosed in the plan.

The ecological consultant carries out walkover surveys for pre and post maintenance works for a representative number of sites. The completed assessment is issued to NPWS and the Department of Arts, Heritage, Regional, Rural, and Gaeltacht Affairs (DAHRRGA).

Arterial drainage works that are not within a Natura 2000 site are still subject to the Appropriate Assessment process, as works that occur outside a Natura 2000 site may remain within the zone of influence of a Natura 2000 site and thus affect the designated habitats and species.

The OPW have also commissioned a number of assessments in relation to protected habitats and species. These have included in the OPW Series of Ecological Impact Assessments as follows:

- Issue No. 2 EclA Raised Bogs
- Issue No. 3 EclA Atlantic Salmon
- Issue No. 4 EclA Otter
- Issue No. 5 EclA Floating River Vegetation
- Issue No. 6 EclA Riparian Birds
- Issue No. 7 EclA Fresh Water Pearl Mussel
- Issue No. 8 EclA Turloughs
- Issue No. 9 EclA 3 Lamprey Species
- Issue No. 10 EclA White-clawed Crayfish
- Issue No. 11 EclA Fens, Mires & Whorl Snails
- Issue No. 12 EclA Kingfisher *Alcedo atthis* & other riparian birds II

2.5.2 Monitoring Programme

The monitoring of Arterial Drainage Maintenance Activities is made-up of two components:

- On-site implementation of OPWs Environmental Management Protocols and Standard Operating Procedures.

- Scientific monitoring programme carried out under EREP, assessing impacts of routine maintenance and capital enhancement projects on the river corridor biodiversity.

The OPW in coordination with Inland Fisheries Ireland (IFI) has an ongoing research programme to assess the impacts of Arterial Drainage Maintenance Activities and the Environmental River Enhancement Programme (EREP) on the river corridor biodiversity and hydromorphology. In addition, a Series of Ecological Assessments (EclA) on Arterial Drainage Maintenance has been published of the effects of drainage maintenance activities on various ecological receptors including otter, Atlantic salmon, raised bogs, etc. The scope of the monitoring is limited to EREP schemes as shown in Figure 2-3.

2.5.3 Auditing

Auditing (both internal and external) of all maintenance activity is carried out in compliance with Environmental Management Protocols and SOPs. These audits are carried out by IFI to assess the extent by which the Environmental Drainage Maintenance (EDM) Guidance Notes are followed by all maintenance activities (including EREP). These external audits cover approximately one-third of the OPW drainage machine crew annually. A rating system was developed by the OPW and monitored by IFI and OPW to identify any particular issues, with particular machine crews.

All audit results are forwarded to the relevant engineer for that drainage scheme within two working weeks. In the event of an audit showing non-compliance with EDM guidelines and SOPs, the relevant engineer is notified within one working day.

2.5.4 Scientific monitoring

The EREP physical and biological monitoring programme assesses the impacts of routine maintenance and capital enhancement projects on the ecology of the river corridor. Flora and fauna (fish, birds, macro-invertebrates, lamprey, and crayfish) are monitored at some sites. The physical changes of the channels are also monitored. The monitoring programme is reviewed periodically and altered as required.

Physical monitoring includes pre works and post works monitoring of a number of variables such as bank-full width, wetted perimeter width, channel length, depth, velocity, and canopy cover.

EREP has included monitoring of hydromorphological conditions in its programme. The River Hydromorphology Assessment Technique (RHAT) monitoring system has been approved as the appropriate method to determine hydromorphological status. Other monitoring activities include:

- EREP has included monitoring of hydromorphological conditions in its programme.
- The River Hydromorphology Assessment Technique (RHAT) monitoring system has been approved as the appropriate method to determine hydromorphological status.
- Floral monitoring: Aquatic (in-channel), marginal vegetation, and riparian vegetation. A walkover survey comprised of a species inventory, as well as, tree survey.
- Macro-invertebrate monitoring: Sampling is carried out at both experimental and control sites, where species inventories are compiled.
- Fish sampling: The primary focus of EREP fish stock survey is salmon and sea trout, however, data from all species encountered during survey are recorded.
- Bird population studies: Key objective of bird surveys are to record abundance, species richness, and distribution of bird species in OPW channels and assess the impact of drainage on bird species.
- Lamprey and fish studies: OPW funded studies carried out by IFI to examine effects of Arterial Drainage Maintenance Activities on lamprey and white-clawed cray fish. Ecological Impact Assessment (EclA) were carried out for both species which recommended further studies. The surveys include monitoring population size and age structure, prior to and in a series of years following maintenance.

2.5.5 Data Recording

The OPW takes a proactive approach to the national recording of environmentally sensitive species on Arterial Drainage Maintenance scheme channels. Locations of species including crayfish, lamprey, kingfisher and Freshwater Pearl Mussel are recorded on the Weekly Records Cards by OPW Industrial staff. The datasets are reviewed periodically and once approved, the datasets are available at all OPW Regional offices

Records are stored in GIS spatial datasets and are currently available to all drainage maintenance staff through maps and will be made available through the OPW Drainage Maintenance application immediately. Increased environmental performance has led to the development of a broader spectrum of GIS datasets to include the current national environmental topics. These datasets will also be uploaded onto the OPW Drainage Maintenance app in due course and will include the following:

- Invasive species
- Other environmental sensitivities
- Habitat mapping
- Habitat photos
- Bridge photos

2.5.6 OPW Current Pilot Studies

Forms of habitat enhancement works are carried out on an ongoing basis within Drainage Maintenance operations. The OPW's EREP, which drives river corridor enhancement works both in and outside the Natura 2000 Sites. All OPW drainage regions are involved in other enhancement projects where the opportunity has arisen. The Western Region directly supports the *Lagarosiphon* invasive species project, which is controlling this invasive in the Lough Corrib SAC. The OPW's South West Region is a project partner and heavily involved in the Mulkear Life Project, which is conducting various works to improve the Mulkear SAC. The Eastern Region have completed a major improvement to fish continuity barriers as part of the Tolka Flood Relief Scheme which resulted in sea trout gaining access to the upper Tolka for the first time in 150 years. For all regions, a bat box pilot scheme is underway with Bat Conservation Ireland. The drainage maintenance role in a wide range of environmental enhancement is an ongoing practice with each case being judged on its merits/shortcomings and applicability.

For SPAs, restoration has been carried out successfully on one site, Glen Lough SPA. This SPA was a component of a European Court of Justice ruling against Ireland on the EU Birds Directive. Restoration works were carried out by OPW in consultation with the DEHLG. This site comprises a seasonal lake with a drainage channel adjacent to it. This permitted restoration measures to accommodate an increase in lake levels without affecting the drainage of the upstream lands reliant on the maintained channel. In the future, Natura 2000 sites that are shown to have potential for restoration, such as Glen Lough should be reviewed on a case-by-case basis.

2.6 Alternatives Considered

The following alternatives to the arterial drainage maintenance programme 2016-2021 were assessed in the SEA and are outlined below.

2.6.1 The 'Do Nothing' Alternative

This is not a viable alternative due to Arterial Drainage Act legislation and therefore was not assessed.

2.6.2 Do minimum

It is plausible that unforeseen circumstances in the next six-years may result in the situation where funding for Arterial Drainage maintenance is cut. An indicative cut in funding by 50% will be assessed and used to evaluate the impacts of a reduced maintenance regime.

With such a reduction in funding there are both positive and negative outcomes in relation to the proposed activities, both of which could occur on the same catchment or even at the same location. The do minimum alternative will more than likely result in more negative impacts than the proposed activities. This is because the reduced funding is most likely to be targeted at maximising the coverage of maintenance activities each year and not allocated to monitoring or changes to planning and onsite activities and approaches.

2.6.3 Do existing

This is the same as the proposed activities, which are no change from current practise.

JBA has carried out a desktop assessment for a number of alternatives that was considered for this SEA and NIS. The full assessment is presented in Appendix C and the main findings of the

assessment are discussed below. The alternatives are assessed against the current maintenance activities.

2.6.4 Alternative 1 – an evolved approach to the selected preferred method activities

This alternative would be the implementation of changes in the planning, supervision and details of activities and mitigation. These changes are to improve both the planning and application of arterial drainage maintenance activities in the following areas:

- M1- Improved maintenance planning (5-year and annual plans),
- M2- Improved Standard Operating Procedures and Environmental Protocol,
- M3-Monitoring of all maintenance activities with continuous improvement through feedback into methods and approach,
- M4-Expansion of river restoration and environmental enhancement
- M5-Assesses Management and Climate Adaptation Planning
- M6-Monitoring of environmental conditions

Under Alternative 1 more positive impacts are expected for most of the objectives of the SEA. As there is no reduction or enhancement in the benefit of arterial drainage schemes, there is no change to the impacts upon some of the social and economic objectives.

This evolved approach to the current activities does allow for planning in advance of the works which will enable environmental constraints to be identified at an early stage and appropriate mitigation measures put in place. This in turn would assist in the provision of more protection for habitats and species, while still meeting the requirements of the Arterial Drainage Act. Water quality would also be maintained, which would ensure compliance with the WFD objectives. Overall, Alternative 1 would support the environmental objectives of the SEA.

Pre-planning would also involve the provision of an archaeological desktop assessment to determine the archaeological potential of the sites in question.

The natural flood management options would require sufficiently more detail and planning. Site selection would be constrained by the presence of Annexed habitats and species and the pathway connectivity to SACs and SPAs. Current land uses, compensation etc. would need to be considered for some of the natural flood management options. Depending on the size and extent of the natural flood management option, an environmental impact assessment and appropriate assessment may be required. The OPW could start investigating this alternative for future activities.

2.6.5 Alternative 2 – different methods to achieve the objective of Arterial Drainage Maintenance

This alternative is based upon the application of different methods to achieve the same objectives. This would include:

- M2- Improved Standard Operating Procedures and Environmental Protocol,

Improved standard operating procedure and environmental protocols are focused on aiming to address concerns from stakeholders on the methods and approaches of specified maintenance activities. The intention of these recommendations is to further facilitate good environmental practices. These should be considered as continual improvement of existing procedure as opposed to new extra procedures.

Under Alternative 2 more positive impacts are expected, however this alternative would be expected to support fewer objectives than Alternative 1. This is because no changes to the planning of maintenance activities are included in this alternative. The current planning approach and systems will remain. Under this alternative, the approach to, and carrying out of maintenance activities in the field will change.

The assessment of this alternative is a limited improvement above current operating procedures and less environmentally effective than Alternative 1.

2.6.6 Alternative 3 – modification of Arterial Drainage Schemes

Alternative 3 is to change the form and function of arterial drainage schemes. This could range from the dis-continuation of certain schemes, broader catchment scale environmental

enhancements and natural flood management (e.g. forestry, restoring natural floodplains and runoff storage).

The application of Alternative 3 for each catchment cannot be determined at present and so the potential impacts are uncertain. It is likely that the benefit of arterial drainage schemes to rural communities and agriculture would reduce. The level at which benefits would be impacted and the compensatory measures applied to manage this cannot be determined at this stage.

2.6.7 Summary of Alternatives

In summary, the assessment of alternatives shows that improvements to the planning, methods and monitoring of arterial drainage maintenance activities would result in more positive impacts than the proposed activities, which are addressed in the SEA as a set of recommended mitigation measures. This NIS also proposes mitigation measures and recommendations in order to reduce and minimise the potential impact posed by drainage maintenance activities to Natura 2000 sites.

3 Stage 1-Screening for Appropriate Assessment

3.1 Introduction

Assessment of the potential impacts of the Arterial Drainage Maintenance Activities (2016-2021) are required under regulation 42 of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011).

This section aims to identify whether the National Arterial Drainage Maintenance Activities (2016-2021) are likely to have a significant impact, either alone, or in-combination with other projects and plans, on the Natura 2000 sites within the area of the catchment.

The 'screening' process addresses and records the reasoning and conclusions in relation to the first two tests of Article 6(3) of the Habitats Directive:

- Is the plan or programme directly connected to or necessary for the management of the site; and
- Will the plan or programme, alone or in-combination with other plans and projects, have a significant effect on a Natura 2000 site in view of its conservation objectives.

If the effects are deemed to be significant, potentially significant or uncertain, then the plan or programme that is under assessment is subject to a Natura Impact Statement.

The National Arterial Drainage Maintenance Activities (2016-2021) are not directly connected to the management of any Natura 2000 sites, however, the Programme activities could have potential to cause significant effects on Natura 2000 sites.

The screening assessment will determine the likelihood of potential impacts on Natural 2000 sites caused by the National Arterial Drainage Maintenance Activities (2016-2021).

3.2 Screening Methodology

In accordance with DEHLG guidance, Appropriate Assessment Screening involves four steps:

1. Description of the Programme (refer to Section 2 Programme Description).
2. Identification of relevant Natura 2000 sites and compilation of information on their qualifying features and conservation objectives. This is presented in Section 3.3.1.
3. Assessment of the likely effects of the Programme including direct, indirect and cumulative effects. This is presented in Section 3.6.
4. Screening Statement with conclusions. This is presented in Section 3.7.

The following OPW guidance was also referred to where applicable: Stage 1: Appropriate Assessment Screening Methodology for the Maintenance of Arterial Drainage Schemes (Ryan Hanley, 2014b) [refer to Figure 3-1]. The OPW Chaings for Appropriate Assessment (source>pathway>receptor); Arterial Drainage Maintenance Categories (Ryan Hanley, 2014a). [refer to Figure 3-2].

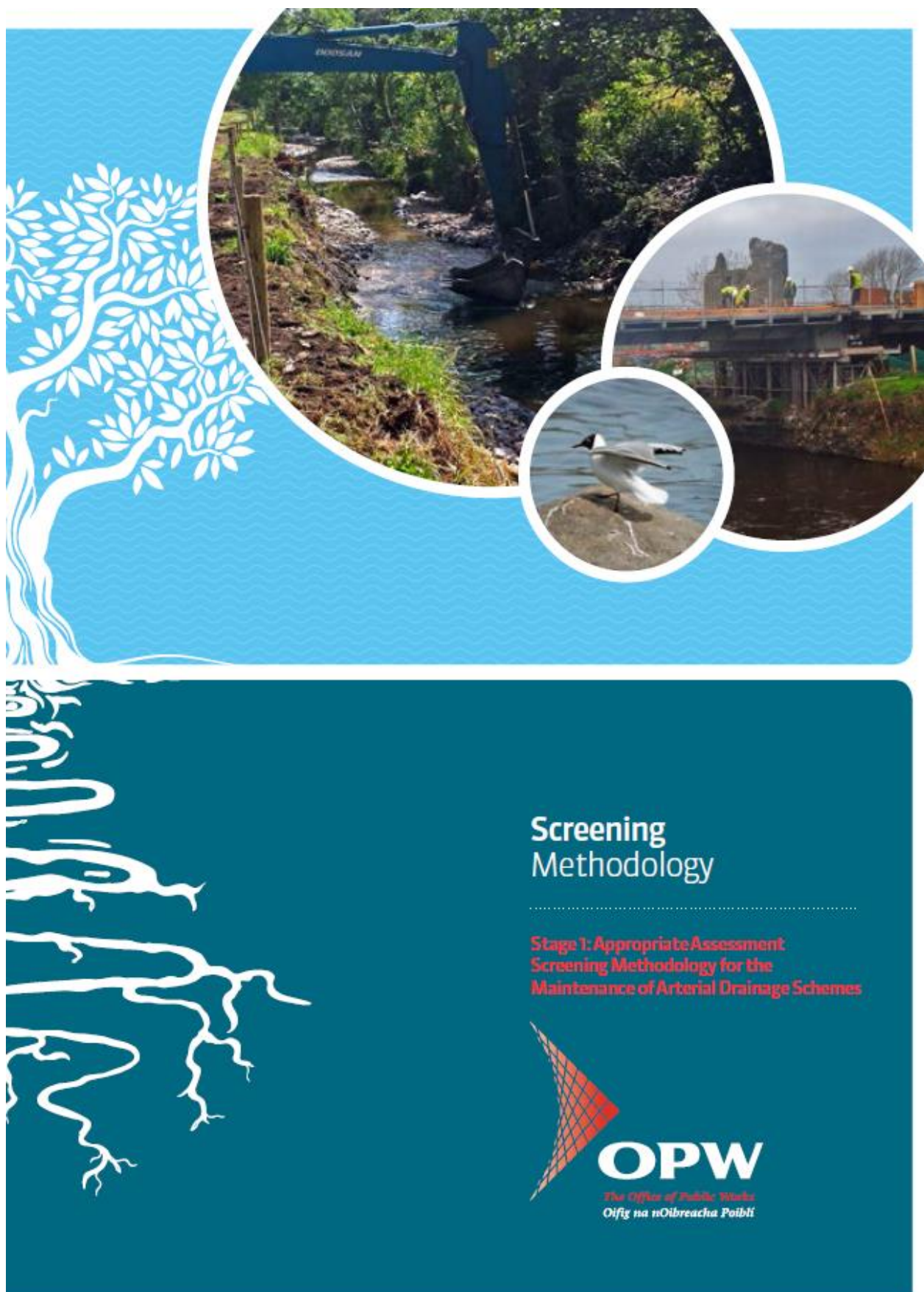


Figure 3-1. OPW Stage 1: Appropriate Assessment Screening Methodology for the Maintenance of Arterial Drainage Scheme.

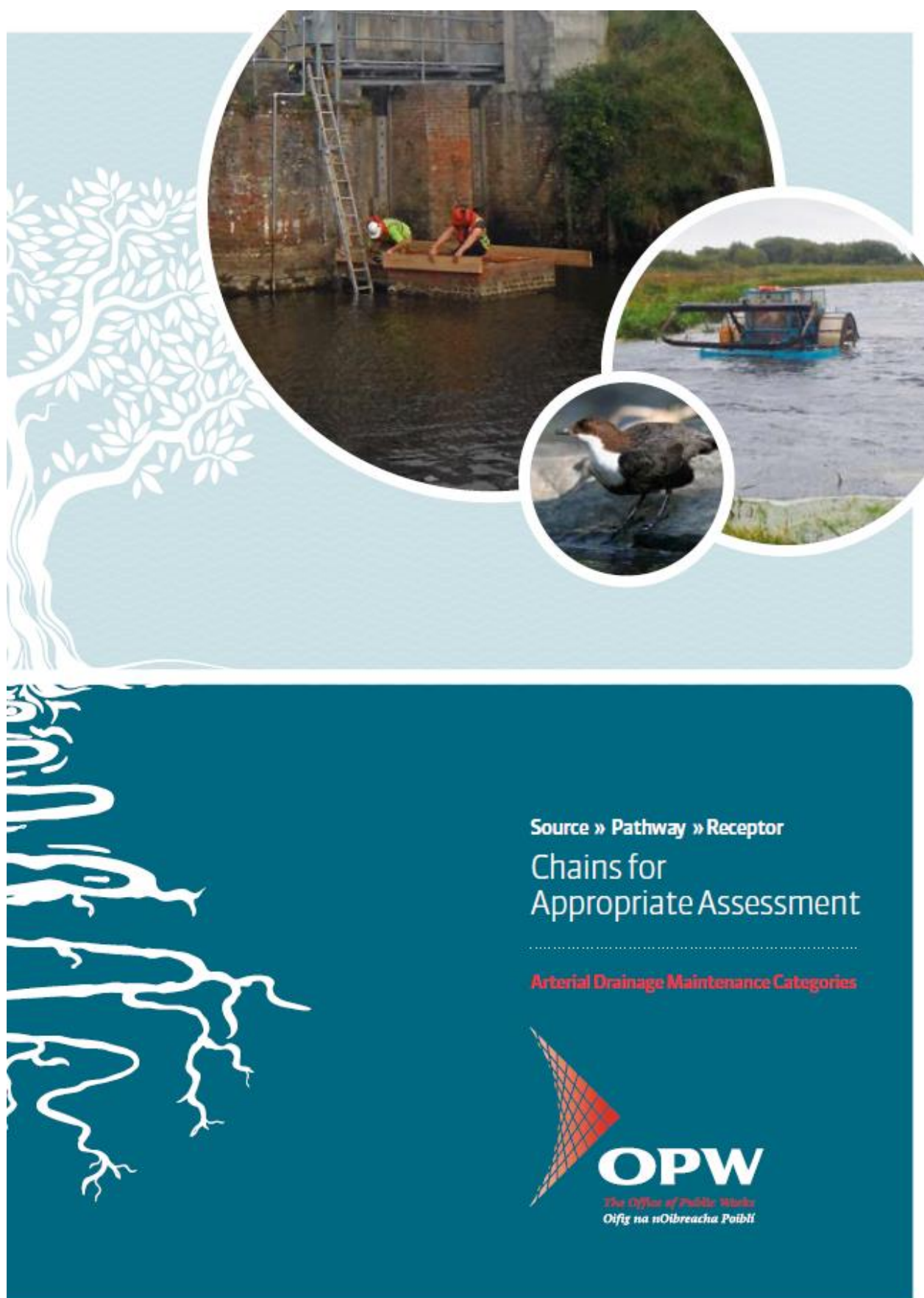


Figure 3-2. OPW Chains for Appropriate Assessment: Arterial Drainage Categories

3.3 Study Area

The following section describes how the screening was carried out at various scales to ensure inclusion of all Natura 2000 sites that may be potentially impacted by the National Arterial Drainage Maintenance Activities (2016-2021).

3.3.1 Identification of Relevant Natura 2000 Sites

The relevant Natura 2000 sites were identified dependant on several factors. This included at catchment scale for both surface and groundwater, at 15km scale and also for FWPM designated Natura 2000 sites at 3km upstream and 35km downstream. Consultation was carried out with EPA staff in relation to the catchment level screenings and GWDTEs.

Data for this process was obtained from the WFD and NPWS website and provided by the OPW, then visualised and assessed using ArcGIS and Microsoft Excel. Further details of the relevant Natura 2000 sites within the likely zones of impact of the potential areas of proposed works are presented in tables in Section 3.3.

The levels of consideration for potential impacts on Natura 2000 sites are discussed here:

3.3.1.1 WFD Catchment Scale

The catchment scales, as defined under the Water Framework, were used as these take into consideration both surface and groundwater pathways within each entire catchment.

For groundwater, the catchment area, contributing water to each Groundwater Dependent Terrestrial Ecosystem (GWDTE) of Natura 2000 sites, is used as the zone of influence of the groundwater pathways from the arterial drainage schemes. These are based upon the WFD risk assessments and WFD GWDTE maps. According to the WFD assessment guidance, for potential abstraction due to arterial drainage the impact is considered High within 100m of a GWDTE, and for the impact of pollutants or nutrients the zone of influence varies according to a number of factors including aquifer vulnerability. As current catchment areas for GWDTEs is still undergoing determinations (EPA), a precautionary approach to the cumulative impacts of schemes, is taken and therefore the entire groundwater catchment area of the GWDTEs is used for this assessment.

3.3.1.2 15km Scale

A buffer area of 15km was used for selection of Natura 2000 sites, based on DEHLG Guidance (DEHLG, 2010), which is the distance considered appropriate for Plans. This 15km buffer also addresses the potential land and air pathways, as the distances defined in Ryan Hanley, 2014b for land and air pathways, are well accommodated within 15km. Within each surface water catchment, Natura 2000 sites (other than those containing freshwater pearl mussel, see below) were selected based on their proximity to the proposed areas of potential works and their full or partial presence within the catchment of the works. This distance was evaluated on a case by case basis, dependent on the nature of the Qualifying Interests present and the nature of the works, if known. The method used in this current assessment is a slight variation on the method of Ryan Hanley (2014b), as it uses more up to date information regarding potential pathways present in a catchment. The Ryan Hanley method, if it were used, would remove Natura 2000 sites with no surface water connectivity to a scheme, but which are situated within the catchment of a scheme and this may result in the exclusion of a Natura 2000 sites that may be potentially impacted by land and air pathways. Therefore, the use of the hydrometric catchment and 15km buffer will, by default, include Natura 2000 sites potentially impacted by land and air pathways.

3.3.1.3 Freshwater Pearl Mussel (FWMP)

In order to take into account freshwater pearl mussel (*Margaritifera margaritifera* and/or *Margaritifera durrovensis*) populations, the Natura 2000 sites within the catchment of potential scheme works and also within 35km downstream (Ryan Hanley 2014) were initially selected for to include for Natura 2000 sites containing freshwater pearl mussel populations. In relation to freshwater pearl mussel, Natura 2000 sites that have FWPM as a qualifying interest were assessed and then on a case by case basis, the location of possible FWPM populations were examined. Using the FWPM sensitive areas, schemes located 3 km upstream and 35km downstream of FWPM sensitive areas and were determined to potentially be impacted.

Natura 2000 sites located outside of the scheme's surface water and groundwater catchment were screened out on the basis that there would be no impact on Natura 2000 sites outside of the catchment. Those sites within Scheme catchments then proceeded to a more detailed review by a

suitably qualified ecologist in JBA Ireland and were either screened in or out on the basis of the following criteria:

- Distance from the Drainage Scheme at various levels based upon an adapted methodology from Ryan Hanley (2014b) including the WFD surface, 15km buffer and groundwater catchments and the 35km downstream buffer for FWPM;
- Hydrological connectivity to channels under maintenance;
- Potential pathways (land, air, groundwater, surface water) likely from the Drainage Scheme to the designated Natura 2000 site;
- Qualifying interests and special conservation interests for which the site was selected and their sensitivities e.g. GWDTEs; and
- The conservation objectives for those sites.

For those Natura 2000 sites that were screened in, the following data was collated:

- Site designation code;
- Site designation name;
- Qualifying interests and special conservation interests for which the site was selected, including habitats and species listed under Annex I and Annex II of the Habitats Directive and Annex I of the Birds Directive;
- Conservation objectives for the site;
- Where conservation objectives were not available for a site, they were obtained for the same qualifying interests elsewhere for another site where available and interpreted for the purposes of this assessment by a suitably qualified ecologist;
- Additional relevant information from supporting documents.

3.4 Findings of the Screening Process

A total of 45 OPW drainage and embankment schemes were assessed on the criteria described in Section 3.3.1. Based on the information provided by the OPW for each scheme, 44 of these schemes have the potential to impact Natura 2000 sites. The only scheme that doesn't have the potential to impact a Natura 2000 site, and was therefore screened out, is the Monaghan Blackwater arterial drainage scheme.

3.4.1 FWPM

Schemes that may impact on Natura 2000 sites designated for freshwater pearl mussel, as they are located within 3km upstream or 35km downstream of a freshwater pearl mussel sensitive area are listed below:

- Bandon River (Dunmanway)
- Ouvane
- Maine
- Woodford
- Moy
- Carrick on-suir
- Feale

The findings of the screening process are presented in Table 3-1 to Table 3-45 for each OPW drainage or embankment scheme per WFD catchment.

3.4.2 Ballyteigue-Bannow Catchment

Ballyteigue/Kilmore Embankment and Drainage Scheme

Table 3-1. Ballyteigue Kilmore Embankment and Drainage Scheme

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Ballyteigue Burrow SAC (000696)	Yes	No	No
Ballyteigue Burrow SPA (004020)	Yes	No	Yes
Bannow Bay SAC (000697)	Yes	No	No
Bannow Bay SPA (004033)	Yes	No	Yes
Carnsore Point SAC (002269)	Yes	No	No
Hook Head SAC (000764)	Yes	No	No
Lady'S Island Lake SAC (000704)	Yes	No	No
Lady's Island Lake SPA (004009)	Yes	No	Yes
River Barrow And River Nore SAC (002162)	No	Yes	Yes
Tacumshin Lake SAC (000709)	Yes	No	No
Tacumshin Lake SPA (004092)	Yes	No	Yes
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

3.4.3 Bandon-Ilen Catchment

Bandon River (Dunmanway) Flood Relief Scheme (FRS)

Table 3-2. Bandon River (Dunmanway) FRS and Embankment Scheme

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Bandon River SAC (002171)	Yes	Yes	No
Barley Cove to Ballyrisode Point SAC (001040)	No	No	No
Castletownshend SAC (001547)	No	No	No
Clonakilty Bay SAC (000091)	No	No	No
Clonakilty Bay SPA (004081)	No	No	Yes
Courtmacsherry Bay SPA (004219)	No	No	Yes
Courtmacsherry Estuary SAC (001230)	No	No	No
Galley Head to Duneen Point SPA (004190)	No	No	No
Kilkeran Lake And Castlefereke Dunes SAC (001061)	No	No	No
Lough Hyne Nature Reserve And Environs SAC (000097)	No	No	No
Myross Wood SAC (001070)	No	No	No
Old Head of Kinsale SPA (004021)	No	No	No
Roaringwater Bay And Islands SAC (000101)	No	No	No
Seven Heads SPA (004191)	No	No	No
Sheeps Head to Toe Head SPA (004156)	No	No	No
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		Yes	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

3.4.4 Boyne Catchment

Boyne Arterial Drainage Scheme

Table 3-3. Boyne Scheme

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Boyne Coast And Estuary SAC (001957)	Yes	No	No
Boyne Estuary SPA (004080)	Yes	No	Yes
Killyconny Bog (Cloghbally) SAC (000006)	No	No	Yes
Lough Bane And Lough Glass SAC (002120)	No	No	No
Lough Lene SAC (002121)	No	No	No
Mount Hevey Bog SAC (002342)	No	No	Yes
Raheenmore Bog SAC (000582)	No	No	Yes
River Boyne And River Blackwater SAC (002299)	Yes	No	Yes
River Boyne and River Blackwater SPA (004232)	Yes	No	No
White Lough, Ben Loughs and Lough Doo SAC (001810)	No	No	No
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

3.4.5 Calligan-Mahon Catchment

Brickey Arterial Drainage Scheme

Table 3-4. Brickey Scheme

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Ardmore Head SAC (002123)	Yes	No	No
Blackwater River (Cork/Waterford) SAC (002170)	Yes	Yes	No
Comeragh Mountains SAC (001952)	Yes	No	Yes
Dungarvan Harbour SPA (004032)	Yes	No	Yes
Glendine Wood SAC (002324)	Yes	No	No
Helvick Head SAC (000665)	Yes	No	No
Helvick Head to Ballyquin SPA (004192)	Yes	No	No
Mid-Waterford Coast SPA (004193)	Yes	No	No
River Barrow And River Nore SAC (002162)	No	Yes	Yes
Tramore Back Strand SPA (004027)	No	No	Yes
Tramore Dunes And Backstrand SAC (000671)	No	No	No
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

3.4.6 Corrib Scheme

Corrib Arterial Drainage Scheme and Embankment Sub-Schemes Clare and Mask

Table 3-5. Corrib Scheme

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Ardkill Turlough SAC (000461)	Yes	No	No
Ballymaglancy Cave, Cong SAC (000474)	Yes	No	No
Carrowkeel Turlough SAC (000475)	Yes	No	No
Cloughmoyne SAC (000479)	Yes	No	No
Clyard Kettle-Holes SAC (000480)	Yes	No	No
Connemara Bog Complex SAC (002034)	Yes	No	Yes
Galway Bay Complex SAC (000268)	Yes	No	Yes
Gortnandarragh Limestone Pavement SAC (001271)	No	No	No
Greaghans Turlough SAC (000503)	Yes	No	No
Kildun Souterrain SAC (002320)	Yes	No	No
Kilglassan/Caheravoostia Turlough Complex SAC (000504)	Yes	No	No
Levally Lough SAC (000295)	Yes	No	No
Lisnageeragh Bog And Ballinastack Turlough SAC (000296)	Yes	No	Yes
Lough Carra SPA (004051)	Yes	No	No
Lough Carra/Mask Complex SAC (001774)	Yes	No	Yes
Lough Corrib SAC (000297)	Yes	Yes	Yes
Lough Corrib SPA (004042)	Yes	No	Yes
Lough Lurgen Bog/Glenamaddy Turlough SAC (000301)	Yes	No	Yes
Lough Mask SAC (004062)	Yes	No	No
Lough Mask SPA (004062)	Yes	No	Yes
Maumturk Mountains SAC (002008)	No	No	No

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Mocorha Lough SAC (001536)	Yes	No	No
Monivea Bog SAC (002352)	Yes	No	Yes
Moore Hall (Lough Carra) SAC (000527)	Yes	No	No
Mweelrea/Sheeffry/Erriff Complex SAC (001932)	No	Yes	Yes
Ross Lake And Woods SAC (001312)	Yes	No	No
Shrule Turlough SAC (000525)	Yes	No	No
Skealaghan Turlough SAC (000541)	Yes	No	No
Towerhill House SAC (002179)	Yes	No	No
Williamstown Turloughs SAC (002296)	Yes	No	No
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

3.4.7 Dunmanus-Bantry-Kenmare Catchment

Ouvane Arterial Drainage Scheme

Table 3-6. Ovane Scheme

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Ballinskelligs Bay And Inny Estuary SAC (000335)	No	No	No
Barley Cove To Ballyrisode Point SAC (001040)	No	No	No
Beara Peninsula SPA (004155)	No	No	No
Blackwater River (Kerry) SAC (002173)	No	Yes	No
Caha Mountains SAC (000093)	Yes	No	No
Cleanderry Wood SAC (001043)	No	No	No
Cloonee And Inchiquin Loughs, Uragh Wood SAC (001342)	No	No	No
Derryclogher (Knockboy) Bog SAC (001873)	Yes	No	No
Drongawn Lough SAC (002187)	No	No	No
Dunbeacon Shingle SAC (002280)	No	No	No
Farranamanagh Lough SAC (002189)	No	No	No
Glanlough Woods SAC (002315)	Yes	No	No
Glanmore Bog SAC (001879)	No	Yes	No
Glengarriff Harbour And Woodland SAC (000090)	Yes	No	No
Iveragh Peninsula SPA (004154)	No	No	No
Kenmare River SAC (002158)	No	No	Yes
Kilgarvan Ice House SAC (000364)	No	No	No
Killarney National Park SAC (004038)	No	No	No
Killarney National Park, Macgillycuddy'S Reeks And Caragh River Catchment SAC (000365)	No	Yes	No
Maulagowna Bog SAC (001881)	No	No	No
Mucksna Wood SAC (001371)	No	No	No

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Old Domestic Building, Askive Wood SAC (002098)	No	No	No
Old Domestic Building, Dromore Wood SAC (000353)	No	No	No
Puffin Island SPA (004003)	No	No	No
Reen Point Shingle SAC (002281)	No	No	No
Sheep'S Head SAC (000102)	No	No	No
Sheeps Head to Toe Head SPA (004156)	No	No	No
Three Castle Head To Mizen Head SAC (000109)	No	No	No
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		Yes	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

3.4.8 Erne Catchment

1. Abbey Arterial Drainage Scheme
2. Duff Arterial Drainage Scheme
3. Kilcoo Arterial Drainage Scheme

Table 3-7. Abbey OPW Scheme (Channel, Embankment, FRS)

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Arroo Mountain SAC (001403)	Yes	No	Yes
Ben Bulbin, Gleniff And Glenade Complex SAC (000623)	No	No	No
Boleybrack Mountain SAC (002032)	No	No	Yes
Bunduff Lough And Machair/Trawalua/Mullaghmore SAC (000625)	Yes	No	No
Corratirrim SAC (000979)	No	No	Yes
Cuilcagh - Anierin Uplands SAC (000584)	No	No	Yes
Donegal Bay (Murvagh) SAC (000133)	Yes	No	No
Dunmuckrum Turloughs SAC (002303)	Yes	No	Yes
Kilroosky Lough Cluster SAC (001786)	No	No	No
Lough Golagh And Breesy Hill SAC (002164)	Yes	No	No
Lough Melvin SAC (000428)	Yes	No	No
Lough Nageage SAC (002135)	No	No	Yes
Lough Oughter And Associated Loughs SAC (000007)	No	No	Yes
Lough Oughter Complex SPA (004049)	No	No	No
Slieve Beagh SPA(004167)	No	No	No
Sligo/Leitrim Uplands SPA (004187)	No	No	No
Tamur Bog SAC (001992)	Yes	No	Yes
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

Table 3-8. Duff OPW Scheme

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Arroo Mountain SAC (001403)	Yes	No	Yes
Ben Bulbin, Gleniff And Glenade Complex SAC (000623)	Yes	No	No
Boleybrack Mountain SAC (002032)	No	No	Yes
Bunduff Lough and Machair/Trawalua/Mullaghmore SAC (000625)	Yes	No	No
Corratirrim SAC (000979)	No	No	Yes
Cuilcagh - Anierin Uplands SAC (000584)	No	No	Yes
DONEGAL BAY SPA (004151)	Yes	No	No
Dunmuckrum Turloughs SAC (002303)	Yes	No	Yes
Kilroosky Lough Cluster SAC (001786)	No	No	No
Lough Golagh And Breesy Hill SAC (002164)	Yes	No	No
Lough Melvin SAC (000428)	No	No	No
Lough Nageage SAC (002135)	No	No	Yes
Lough Oughter And Associated Loughs SAC (000007)	No	No	Yes
Lough Oughter Complex SPA (004049)	No	No	No
Slieve Beagh SPA(004167)	No	No	No
Sligo/Leitrim Uplands SPA (004187)	Yes	No	No
Tamur Bog SAC (001992)	No	No	Yes
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

Table 3-9. Kilcoo OPW Scheme

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Arroo Mountain SAC (001403)	Yes	No	Yes
Ben Bulbin, Gleniff and Glenade Complex SAC (000623)	Yes	No	Yes
Boleybrack Mountain SAC (002032)	Yes	No	No
Bunduff Lough and Machair/Trawalua/Mullaghmore SAC (000625)	No	No	Yes
Corratirrim SAC (000979)	Yes	No	No
Cuilcagh - Anierin Uplands SAC (000584)	No	No	Yes
Donegal Bay SPA (004151)	No	No	Yes
Dunmuckrum Turloughs SAC (002303)	No	No	No
Kilroosky Lough Cluster SAC (001786)	No	No	Yes
Lough Golagh and Breesy Hill SAC (002164)	No	No	No
Lough Melvin SAC (000428)	Yes	No	No
Lough Nageage SAC (002135)	No	No	No
Lough Oughter And Associated Loughs SAC (000007)	No	No	Yes
Lough Oughter Complex SPA (004049)	No	No	Yes
Slieve Beagh SPA(004167)	Yes	No	No
Sligo/Leitrim Uplands SPA (004187)	Yes	No	No
Tamur Bog SAC (001992)	No	No	No
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

3.4.9 Foyle Catchment

Donegal sub-schemes

1.Clooburn Arterial Drainage Scheme**2.Deele and Swillyburn Estuarine Embankment Scheme**

Table 3-10. Donegal Schemes (Deele and Swillyburn Estuarine Embankment and Cloonburn)

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Cloghernagore Bog and Glenveagh National Park SAC (002047)	No	Yes	No
Croaghonagh Bog SAC (000129)	No	No	No
Derryveagh And Glendowan Mountains SPA (004039)	No	No	No
Dunragh Loughs/Pettigo Plateau SAC (001125)	No	No	No
Lough Derg (Donegal) SPA (004057)	No	No	No
Meenaguse Scragh SAC (001880)	No	No	No
Meentygrannagh Bog SAC (000173)	No	No	Yes
Pettigo Plateau Nature Reserve SAC (004099)	No	No	No
River Finn SAC (002301)	Yes	No	Yes
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

3.4.10 Lough Swilly Catchment

Donegal sub-schemes:

1. **Swilly Embankments Estuarine Embankment Scheme**
2. **Skeog and Burnfoot Estuarine Embankment Scheme**
3. **Blanket Nook Estuarine Embankment Scheme**
4. **Bridge End Flood Relief Scheme**

Table 3-11. Donegal Schemes (Swilly Embankments, Blanket Nook, Skeoge and Burnfoot Estuarine Embankments)

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Ballyarr Wood SAC (000116)	Yes	No	No
Ballyhoorisky Point to Fanad Head SAC (001975)	No	No	Yes
Cloghernagore Bog and Glenveagh National Park SAC (002047)	Yes	Yes	No
Derryveagh And Glendowan Mountains SPA (004039)	Yes	No	No
Fanad Head SPA (004148)	No	No	No
Horn Head to Fanad Head SPA (004194)	Yes	No	No
Leannan River SAC (002176)	Yes	Yes	No
Lough Fern SPA (004060)	Yes	No	Yes
Lough Swilly SAC (002287)	Yes	No	No
Lough Swilly SPA (004075)	Yes	No	Yes
Meentygrannagh Bog SAC (000173)	Yes	No	Yes
North Inishowen Coast SAC (002012)	No	No	Yes
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

3.4.11 Galway Bay Southeast

Includes Gort Flood Relief Scheme and Ilackan

Table 3-12. Gort FRS

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Ardrahan Grassland SAC (002244)	Yes	No	No
Ballinduff Turlough SAC (002295)	Yes	No	No
Ballyvaughan Turlough SAC (000996)	No	No	No
Black Head-Poulsallagh Complex SAC (000020)	No	No	Yes
Caherglassaun Turlough SAC (000238)	Yes	No	Yes
Cahermore Turlough SAC (002294)	Yes	No	No
Carrowbaun, Newhall And Ballylee Turloughs SAC (002293)	Yes	No	No
Castletaylor Complex SAC (000242)	Yes	No	No
Coole-Garryland Complex SAC (000252)	Yes	No	Yes
Coole-Garryland SPA (004107)	Yes	No	No
Cregganna Marsh SPA (004142)	No	No	No
Drummin Wood SAC (002181)	Yes	No	No
East Burren Complex SAC (001926)	Yes	No	Yes
Galway Bay Complex SAC (000268)	Yes	No	Yes
Gortacarnaun Wood SAC (002180)	Yes	No	No
Inner Galway Bay SPA (004031)	Yes	No	Yes
Kiltartan Cave (Coole) SAC (000286)	Yes	No	No
Kiltiernan Turlough SAC (001285)	Yes	No	No
Lough Coy SAC (002117)	Yes	No	No
Lough Cutra SAC (000299)	Yes	No	No
Lough Cutra SPA (004056)	Yes	No	No
Lough Fingall Complex SAC (000606)	Yes	No	No
Lough Rea SAC (000304)	No	No	No
Lough Rea SPA (004134)	No	No	Yes
Moneen Mountain SAC (000054)	No	No	Yes
Monivea Bog SAC (002352)	No	No	Yes
Peterswell Turlough SAC	Yes	No	Yes

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
(000318)			
Rahasane Turlough SAC (000322)	No	No	No
Rahasane Turlough SPA (004089)	No	No	Yes
Slieve Aughty Mountains SPA (004168)	Yes	No	No
Sonnagh Bog SAC (001913)	Yes	No	No
Termon Lough SAC (001321)	Yes	No	No
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

Table 3-13. Lackan Embankment Scheme

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Ardrahan Grassland SAC (002244)	Yes	No	No
Ballinduff Turlough SAC (002295)	Yes	No	No
Ballyvaughan Turlough SAC (000996)	No	No	No
Black Head-Poulsallagh Complex SAC (000020)	No	No	Yes
Caherglassaun Turlough SAC (000238)	Yes	No	Yes
Cahermore Turlough SAC (002294)	Yes	No	No
Carrowbaun, Newhall And Ballylee Turloughs SAC (002293)	Yes	No	No
Castletaylor Complex SAC (000242)	Yes	No	No
Coole-Garryland Complex SAC (000252)	Yes	No	Yes
Coole-Garryland SPA (004107)	Yes	No	No
Cregganna Marsh SPA (004142)	Yes	No	No
Drummin Wood SAC (002181)	Yes	No	No
East Burren Complex SAC (001926)	Yes	No	Yes
Galway Bay Complex SAC (000268)	Yes	No	Yes
Gortacarnaun Wood SAC (002180)	Yes	No	No
Inner Galway Bay SPA (004031)	Yes	No	Yes
Kiltartan Cave (Coole) SAC (000286)	Yes	No	No
Kiltiernan Turlough SAC (001285)	Yes	No	No
Lough Coy SAC (002117)	Yes	No	No
Lough Cutra SAC (000299)	Yes	No	No
Lough Cutra SPA (004056)	Yes	No	No
Lough Fingall Complex SAC (000606)	Yes	No	No
Lough Rea SAC (000304)	Yes	No	No
Lough Rea SPA (004134)	Yes	No	Yes
Moneen Mountain SAC (000054)	No	No	Yes
Monivea Bog SAC (002352)	No	No	Yes
Peterswell Turlough SAC (000318)	Yes	No	Yes
Rahasane Turlough SAC (000322)	Yes	No	No
Rahasane Turlough SPA	Yes	No	Yes

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
(004089)			
Slieve Aughty Mountains SPA (004168)	Yes	No	No
Sonnagh Bog SAC (001913)	Yes	No	No
Termon Lough SAC (001321)	Yes	No	No
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

3.4.12 Laune-Maine-Dingle Bay

Maine Arterial Drainage Scheme

Table 3-14. Maine Scheme

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Blasket Islands SAC (002172)	No	No	No
Castlemaine Harbour SAC (000343)	Yes	No	Yes
Castlemaine Harbour SPA (004029)	Yes	No	Yes
Dingle Peninsula SPA (004153)	Yes	No	No
Eirk Bog SPA (004108)	No	No	No
Iveragh Peninsula SPA (004154)	Yes	No	No
Killarney National Park SAC (004038)	Yes	No	No
Killarney National Park, Macgillycuddy'S Reeks And Caragh River Catchment SAC (000365)	Yes	Yes	No
Lough Yganavan And Lough Nambrackdarrig SAC (000370)	Yes	No	No
Mount Brandon SAC (000375)	No	Yes	No
Mullaghanish Bog SAC (001890)	No	No	No
Old Domestic Building, Curraglass Wood SAC (002041)	No	No	No
Sheheree (Ardagh) Bog SAC (000382)	No	No	Yes
Slieve Mish Mountains SAC (002185)	Yes	No	No
Stacks to Mullaghareirk Mountains, West Limerick hills and Mount Eagle SPA (004161)	Yes	No	No
Valencia Harbour/Portmagee Channel SAC (002262)	No	No	No
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		Yes	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

3.4.13 Liffey and Dublin Bay Catchment

1. **Ryewater Arterial Drainage Scheme** - The area of works is located within the Ryewater Valley SAC.

2. **Hazelhatch (Shinkeen) Scheme**

Table 3-15. Ryewater Scheme

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Baldoyle Bay SAC (000199)	No	No	No
Baldoyle Bay SPA (004016)	No	No	Yes
Glenasmole Valley SAC (001209)	Yes	No	Yes
Howth Head Coast SPA (004113)	No	No	No
Howth Head SAC (000202)	No	No	No
Malahide Estuary SAC (000205)	No	No	No
Malahide Estuary SPA (004025)	No	No	Yes
Mouds Bog SAC (002331)	No	No	Yes
North Bull Island SPA (004006)	No	No	Yes
North Dublin Bay SAC (000206)	No	No	Yes
Poulaphouca Reservoir SPA (004063)	No	No	No
Red Bog, Kildare SAC (000397)	No	No	Yes
Rockabill to Dalkey Island SAC (003000)	No	No	No
Rye Water Valley/Carton SAC (001398)	Yes	No	Yes
South Dublin Bay and River Tolka Estuary SPA (004024)	No	No	Yes
South Dublin Bay SAC (000210)	No	No	No
Wicklow Mountains SAC (002122)	No	No	No
Wicklow Mountains SPA (004040)	No	No	No
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

Table 3-16. Hazelhatch (Shinkeen) Flood Relief Scheme

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Baldoyle Bay SAC (000199)	No	No	No
Baldoyle Bay SPA (004016)	No	No	Yes
Glenasmole Valley SAC (001209)	Yes	No	Yes
Howth Head SAC (000202)	No	No	No
Howth Head Coast SPA (004113)	No	No	No
Malahide Estuary SAC (000205)	No	No	No
Malahide Estuary SPA (004025)	No	No	Yes
Mouds Bog SAC (002331)	No	No	Yes
North Bull Island SPA (004006)	No	No	Yes
North Dublin Bay SAC (000206)	No	No	Yes
Poulaphouca Reservoir SPA (004063)	No	No	No
Red Bog, Kildare SAC (000397)	Yes	No	Yes
Rockabill to Dalkey Island SAC (003000)	No	No	No
Rye Water Valley/Carlton SAC (001398)	Yes	No	Yes
South Dublin Bay SAC (000210)	No	No	Yes
South Dublin Bay and River Tolka Estuary SPA (004024)	No	No	No
Wicklow Mountains SAC (002122)	Yes	No	No
Wicklow Mountains SPA (004040)	No	No	No
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

3.4.14 Lough Neagh and Lower Bann

Monaghan Blackwater Arterial Drainage Scheme

Table 3-17. Monaghan Blackwater

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Slieve Beagh SPA(004167)	No	No	No
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			No

3.4.15 Lower Shannon (A)

Brosna Arterial Drainage Scheme and Embankment Scheme

Table 3-18. Brosna

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Baldoyle Bay SAC (000199)	No	No	No
Baldoyle Bay SPA (004016)	No	No	Yes
Glenasmole Valley SAC (001209)	Yes	No	Yes
Howth Head SAC (000202)	No	No	No
Howth Head Coast SPA (004113)	No	No	No
Malahide Estuary SAC (000205)	No	No	No
Malahide Estuary SPA (004025)	No	No	Yes
Mouds Bog SAC (002331)	No	No	Yes
North Bull Island SPA (004006)	No	No	Yes
North Dublin Bay SAC (000206)	No	No	Yes
Poulaphouca Reservoir SPA (004063)	No	No	No
Red Bog, Kildare SAC (000397)	Yes	No	Yes
Rockabill to Dalkey Island SAC (003000)	No	No	No
Rye Water Valley/Carton SAC (001398)	Yes	No	Yes
South Dublin Bay SAC (000210)	No	No	Yes
South Dublin Bay and River Tolka Estuary SPA (004024)	No	No	No
Wicklow Mountains SAC (002122)	Yes	No	No
Wicklow Mountains SPA (004040)	No	No	No
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

3.4.16 Lower Shannon (C)

1. Clareen Arterial Drainage Scheme
2. Nenagh Arterial Drainage Scheme
3. Woodford Arterial Drainage Scheme
4. Killimor Arterial Drainage Scheme
5. Carrigahorig Arterial Drainage Scheme

Table 3-19. Clareen Scheme

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Ardgraique Bog SAC (002356)	No	No	Yes
Barroughter Bog SAC (000231)	Yes	No	Yes
Bolingbrook Hill SAC (002124)	No	No	No
Cloonmoylan Bog SAC (000248)	No	No	Yes
Derrycrag Wood Nature Reserve SAC (000261)	No	No	No
Glendree Bog SAC (001912)	No	No	No
Kilcarren-Firville Bog SAC (000647)	No	No	Yes
Kilduff, Devilsbit Mountain SAC (000934)	No	No	No
Liskeenan Fen SAC (001683)	No	No	No
Lough Derg (Shannon) SPA (004058)	Yes	No	Yes
Lough Derg, North-East Shore SAC (002241)	Yes	No	Yes
Loughatorick South Bog SAC (000308)	Yes	No	No
Lower River Shannon SAC (002165)	Yes	Yes	No
Middle Shannon Callows SPA (004096)	No	No	Yes
Pollagoona Bog SAC (002126)	No	No	No
Pollnaknockaun Wood Nature Reserve SAC (000319)	No	No	No
River Shannon Callows SAC (000216)	No	No	No
Rosturra Wood SAC (001313)	No	No	No
Slieve Aughty Mountains SPA (004168)	Yes	No	No
Slieve Bernagh Bog SAC (002312)	Yes	No	No
Slievefelim To Silvermines Mountains SPA (004165)	Yes	No	No
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No	
Groundwater dependent terrestrial ecosystem present within catchment area of works			Yes

Table 3-20. Nenagh Scheme

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Ardgraique Bog SAC (002356)	No	No	Yes
Barroughter Bog SAC (000231)	No	No	Yes
Bolingbrook Hill SAC (002124)	Yes	No	No
Cloonmoylan Bog SAC (000248)	Yes	No	Yes
Derrycrag Wood Nature Reserve SAC (000261)	Yes	No	No
Glendree Bog SAC (001912)	No	No	No
Kilcarren-Firville Bog SAC (000647)	No	No	Yes
Kilduff, Devilsbit Mountain SAC (000934)	Yes	No	No
Liskeenan Fen SAC (001683)	No	No	No
Lough Derg (Shannon) SPA (004058)	Yes	No	Yes
Lough Derg, North-East Shore SAC (002241)	Yes	No	Yes
Loughatorick South Bog SAC (000308)	Yes	No	No
Lower River Shannon SAC (002165)	Yes	Yes	No
Middle Shannon Callows SPA (004096)	No	No	Yes
Pollagoona Bog SAC (002126)	No	No	No
Pollnaknockaun Wood Nature Reserve SAC (000319)	No	No	No
River Shannon Callows SAC (000216)	No	No	No
Rosturra Wood SAC (001313)	No	No	No
Slieve Aughty Mountains SPA (004168)	Yes	No	No
Slieve Bernagh Bog SAC (002312)	No	No	No
Slievefelim To Silvermines Mountains SPA (004165)	Yes	No	No
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No	
Groundwater dependent terrestrial ecosystem present within catchment area of works			Yes

Table 3-21. Woodford Scheme

This scheme is located within a *Margaritifera* sensitive area (NPWS, 2014) within Derrycrag Wood Nature Reserve SAC, up-river of the Lough Derg Shannon SPA.

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Ardgrigue Bog SAC (002356)	No	No	Yes
Barroughter Bog SAC (000231)	Yes	No	Yes
Bolingbrook Hill SAC (002124)	No	No	No
Cloonmoylan Bog SAC (000248)	Yes	No	Yes
Derrycrag Wood Nature Reserve SAC (000261)	Yes	No	No
Glendree Bog SAC (001912)	No	No	No
Kilcarren-Firville Bog SAC (000647)	No	No	Yes
Kilduff, Devilsbit Mountain SAC (000934)	No	No	No
Liskeenan Fen SAC (001683)	No	No	No
Lough Derg (Shannon) SPA (004058)	Yes	No	Yes
Lough Derg, North-East Shore SAC (002241)	Yes	No	Yes
Loughatorick South Bog SAC (000308)	Yes	No	No
Lower River Shannon SAC (002165)	No	Yes	No
Middle Shannon Callows SPA (004096)	Yes	No	Yes
Pollagoona Bog SAC (002126)	Yes	No	No
Pollnaknockaun Wood Nature Reserve SAC (000319)	Yes	No	No
River Shannon Callows SAC (000216)	Yes	No	No
Rosturra Wood SAC (001313)	Yes	No	No
Slieve Aughty Mountains SPA (004168)	Yes	No	No
Slieve Bernagh Bog SAC (002312)	No	No	No
Slievefelim To Silvermines Mountains SPA (004165)	No	No	No
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		Yes*	
Groundwater dependent terrestrial ecosystem present within catchment area of works			Yes

* The area of works is entirely within a catchment with previous records of *Margaritifera*, the population of which when assessed by NPWS in 2014, was recorded as status unknown.

Table 3-22. Killmor Scheme

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Ardgraique Bog SAC (002356)	Yes	No	Yes
Barroughter Bog SAC (000231)	Yes	No	Yes
Bolingbrook Hill SAC (002124)	No	No	No
Cloonmoylan Bog SAC (000248)	No	No	Yes
Derrycrag Wood Nature Reserve SAC (000261)	Yes	No	No
Glendree Bog SAC (001912)	No	No	No
Kilcarren-Firville Bog SAC (000647)	Yes	No	Yes
Kilduff, Devilsbit Mountain SAC (000934)	No	No	No
Liskeenan Fen SAC (001683)	No	No	No
Lough Derg (Shannon) SPA (004058)	Yes	No	Yes
Lough Derg, North-East Shore SAC (002241)	Yes	No	Yes
Loughatorick South Bog SAC (000308)	Yes	No	No
Lower River Shannon SAC (002165)	No	Yes	No
Middle Shannon Callows SPA (004096)	Yes	No	Yes
Pollagoona Bog SAC (002126)	Yes	No	No
Pollnaknockaun Wood Nature Reserve SAC (000319)	Yes	No	No
River Shannon Callows SAC (000216)	Yes	No	No
Rosturra Wood SAC (001313)	Yes	No	No
Slieve Aughty Mountains SPA (004168)	Yes	No	No
Slieve Bernagh Bog SAC (002312)	No	No	No
Slievefelim To Silvermines Mountains SPA (004165)	No	No	No
Sonnagh Bog SAC (001913)	Yes	No	No
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No	
Groundwater dependent terrestrial ecosystem present within catchment area of works			Yes

Table 3-23 Carrigahorig Scheme

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Ardgraique Bog SAC (002356)	Yes	No	Yes
Barroughter Bog SAC (000231)	Yes	No	Yes
Bolingbrook Hill SAC (002124)	No	No	No
Cloonmoylan Bog SAC (000248)	Yes	No	Yes
Derrycrag Wood Nature Reserve SAC (000261)	No	No	No
Glendree Bog SAC (001912)	No	No	No
Kilcarren-Firville Bog SAC (000647)	Yes	No	Yes
Kilduff, Devilsbit Mountain SAC (000934)	No	No	No
Liskeenan Fen SAC (001683)	Yes	No	No
Lough Derg (Shannon) SPA (004058)	Yes	No	Yes
Lough Derg, North-East Shore SAC (002241)	Yes	No	Yes
Loughatorick South Bog SAC (000308)	No	No	No
Lower River Shannon SAC (002165)	No	Yes	No
Middle Shannon Callows SPA (004096)	Yes	No	Yes
Pollagoona Bog SAC (002126)	No	No	No
Pollnaknockaun Wood Nature Reserve SAC (000319)	No	No	No
River Shannon Callows SAC (000216)	Yes	No	No
Rosturra Wood SAC (001313)	Yes	No	No
Slieve Aughty Mountains SPA (004168)	Yes	No	No
Slieve Bernagh Bog SAC (002312)	No	No	No
Slievefelim To Silvermines Mountains SPA (004165)	No	No	No
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

3.4.17 Lower Shannon (D)

1. **Groody,**
2. **Mulkear Cappamore**
3. **Mulkear Ballymackeogh**

Table 3-24. Groody Scheme

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Bolingbrook Hill SAC (002124)	No	No	No
Clare Glen SAC (000930)	Yes	No	No
Glenomra Wood SAC (001013)	No	No	No
Glenstal Wood SAC (001432)	Yes	No	No
Keeper Hill SAC (001197)	No	No	No
Lower River Shannon SAC (002165)	Yes	Yes	No
Lower River Suir SAC (002137)	No	Yes	Yes
Philipston Marsh SAC (001847)	No	No	Yes
River Shannon and River Fergus Estuaries SPA (004077)	Yes	No	Yes
Silvermine Mountains SAC (000939)	No	No	No
Silvermines Mountains West SAC (002258)	No	No	No
Slieve Bernagh Bog SAC (002312)	No	No	No
Slievefelim To Silvermines Mountains SPA (004165)	Yes	No	No
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

Table 3-25 Mulkear Cappamore Scheme

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Bolingbrook Hill SAC (002124)	No	No	No
Clare Glen SAC (000930)	Yes	No	No
Glenomra Wood SAC (001013)	No	No	No
Glenstal Wood SAC (001432)	Yes	No	No
Keeper Hill SAC (001197)	Yes	No	No
Lower River Shannon SAC (002165)	Yes	Yes	No
Philipston Marsh SAC (001847)	Yes	No	Yes
River Shannon and River Fergus Estuaries SPA (004077)	No	No	Yes
Silvermine Mountains SAC (000939)	No	No	No
Silvermines Mountains West SAC (002258)	No	No	No
Slieve Bernagh Bog SAC (002312)	No	No	No
Slievefelim To Silvermines Mountains SPA (004165)	Yes	No	No
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

Table 3-26. Mulkear Ballymackeogh Scheme

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Bolingbrook Hill SAC (002124)	No	No	No
Clare Glen SAC (000930)	Yes	No	No
Glenomra Wood SAC (001013)	Yes	No	No
Glenstal Wood SAC (001432)	Yes	No	No
Keeper Hill SAC (001197)	No	No	No
Lower River Shannon SAC (002165)	Yes	Yes	No
Lower River Suir SAC (002137)	No	Yes	Yes
Philipston Marsh SAC (001847)	No	No	Yes
River Shannon and River Fergus Estuaries SPA (004077)	Yes	No	Yes
Silvermine Mountains SAC (000939)	No	No	No
Silvermines Mountains West SAC (002258)	No	No	No
Slieve Bernagh Bog SAC (002312)	No	No	No
Slievefelim To Silvermines Mountains SPA (004165)	Yes	No	No
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

3.4.17.1 Mal Bay

Table 3-27. Cloghauninchy Scheme

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Ballyteige (Clare) SAC (000994)	No	No	No
Black Head-Poulsallagh Complex SAC (000020)	No	No	Yes
Carrowmore Dunes SAC (002250)	Yes	No	Yes
Carrowmore Point To SPAnish Point And Islands SAC (001021)	Yes	No	Yes
Cliffs of Moher SPA (004005)	No	No	No
Inagh River Estuary SAC (000036)	No	No	No
Kilkee Reefs SAC (002264)	Yes	No	No
Mid-Clare Coast SPA (004182)	Yes	No	Yes
Tullaheer Lough And Bog SAC (002343)	Yes	No	Yes
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

Table 3-28. Creegh Scheme.

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Ballyteige (Clare) SAC (000994)	No	No	No
Black Head-Poulsallagh Complex SAC (000020)	No	No	Yes
Carrowmore Dunes SAC (002250)	Yes	No	Yes
Carrowmore Point To SPAnish Point And Islands SAC (001021)	Yes	No	Yes
Cliffs of Moher SPA (004005)	No	No	No
Inagh River Estuary SAC (000036)	No	No	No
Kilkee Reefs SAC (002264)	Yes	No	No
Mid-Clare Coast SPA (004182)	Yes	No	Yes
Tullaheer Lough And Bog SAC (002343)	Yes	No	Yes
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

3.4.18 Moy and Killala Bay Catchment

Table 3-29. Moy Scheme

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Bolingbrook Hill SAC (002124)	No	No	No
Clare Glen SAC (000930)	Yes	No	No
Glenomra Wood SAC (001013)	Yes	No	No
Glenstal Wood SAC (001432)	Yes	No	No
Keeper Hill SAC (001197)	No	No	No
Lower River Shannon SAC (002165)	Yes	Yes	No
Lower River Suir SAC (002137)	No	Yes	Yes
Philipston Marsh SAC (001847)	No	No	Yes
River Shannon and River Fergus Estuaries SPA (004077)	Yes	No	Yes
Silvermine Mountains SAC (000939)	No	No	No
Silvermines Mountains West SAC (002258)	No	No	No
Slieve Bernagh Bog SAC (002312)	No	No	No
Slievefelim To Silvermines Mountains SPA (004165)	Yes	No	No
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

* Located approximately 2km from adjacent catchment, within the Ballina karstic groundwater body which is a catchment identified by the NPWS in 2014 as being a *Margaritifera* sensitive area due to the presence of other extant populations.

3.4.19 Nanny Delvin Catchment

1. **Duleek (Nanny) Scheme**
2. **Matt Scheme**
3. **Broadmeadow/ Ward Scheme**

Table 3-30. Duleek (Nanny) Scheme

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Malahide Estuary SAC (000205)	No	No	No
Malahide Estuary SPA (004025)	No	No	Yes
River Nanny Estuary And Shore SPA (004158)	Yes	No	Yes
Rogerstown Estuary SAC (000208)	No	No	No
Rogerstown Estuary SPA (004015)	No	No	Yes
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

Table 3-31. Matt Scheme

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Malahide Estuary SAC (000205)	Yes	No	No
Malahide Estuary SPA (004025)	Yes	No	Yes
River Nanny Estuary And Shore SPA (004158)	Yes	No	Yes
Rogerstown Estuary SAC (000208)	Yes	No	No
Rogerstown Estuary SPA (004015)	Yes	No	Yes
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

Table 3-32. Broadmeadow/ Ward

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Malahide Estuary SAC (000205)	Yes	No	No
Malahide Estuary SPA (004025)	Yes	No	Yes
Rogerstown Estuary SAC (000208)	Yes	No	No
Rogerstown Estuary SPA (004015)	Yes	No	Yes
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

3.4.20 Newry, Fane, Glyde and Dee catchment

Table 3-33. Glyde and Dee Scheme

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Boyne Coast And Estuary SAC (001957)	Yes	No	No
Boyne Estuary SPA (004080)	Yes	No	Yes
Carlingford Lough SPA (004078)	No	No	Yes
Carlingford Mountain SAC (000453)	No	No	Yes
Carlingford Shore SAC (002306)	No	No	No
Clogher Head SAC (001459)	Yes	No	No
Dundalk Bay SAC (000455)	Yes	No	No
Dundalk Bay SPA (004026)	Yes	No	Yes
Stabannan-Braganstown SPA (004091)	Yes	No	No
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

3.4.21 Nore Catchment

Table 3-34. Kilkenny Scheme

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Coolrain Bog SAC (002332)	No	No	Yes
Cullahill Mountain SAC (000831)	No	No	No
Galmoy Fen SAC (001858)	No	No	Yes
Hugginstown Fen SAC (000404)	No	No	Yes
Knockacoller Bog SAC (002333)	No	No	Yes
Lisbigney Bog SAC (000869)	No	No	Yes
Lower River Suir SAC (002137)	No	Yes	Yes
River Barrow And River Nore SAC (002162)	Yes	Yes	Yes
River Nore SPA (004233)	Yes	No	No
Slieve Bloom Mountains SAC (000412)	No	No	No
Slieve Bloom Mountains SPA (004160)	No	No	No
Spahill And Clomantagh Hill SAC (000849)	No	No	No
The Loughans SAC (000407)	No	No	No
Thomastown Quarry SAC (002252)	Yes	No	Yes
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No*	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

* Works are located at approximately 5 km downriver of a *Margaritifera* sensitive area. The area of works must not extend beyond this area if they are to be covered by this assessment.

3.4.22 Owenavorrach Catchment

Scheme located on the Owenavorrach River which enters the sea near Courttown. Not directly linked to any Natura 2000 sites.

Table 3-35. Owenavorrach Scheme

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Cahore Marshes SPA (004143)	Yes	No	Yes
Cahore Polders And Dunes SAC (000700)	Yes	No	No
Kilmuckridge-Tinnaberna Sandhills SAC (001741)	No	No	No
Raven Point Nature Reserve SAC (000710)	No	No	Yes
Screen Hills SAC (000708)	No	No	No
The Raven SPA (004019)	No	No	Yes
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

3.4.23 Shannon Estuary North Catchment

1. **Shannon Embankments North Arterial Drainage Scheme and sub-schemes Bunratty Rineanna, Coonagh and Fergus**
2. **Sixmilebridge (Owenagarney) Scheme**

Table 3-36. Shannon Embankment North Scheme

This scheme is located on the banks of the Lower River Shannon SAC.

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Ballyallia Lake SAC (000014)	No	No	No
Ballyallia Lough SPA (004041)	No	No	Yes
Ballycullinan Lake SAC (000016)	No	No	No
Ballycullinan, Old Domestic Building SAC (002246)	No	No	No
Ballyogan Lough SAC (000019)	No	No	No
Corofin Wetlands SPA (004220)	No	No	Yes
Cregg House Stables, Crusheen SAC (002317)	No	No	No
Danes Hole, Poulnalecka SAC (000030)	Yes	No	No
Dromore Woods And Loughs SAC (000032)	No	No	Yes
East Burren Complex SAC (001926)	No	No	Yes
Kilkee Reefs SAC (002264)	No	No	No
Kilkishen House SAC (002319)	Yes	No	No
Knockanira House SAC (002318)	No	No	No
Loop Head SPA (004119)	No	No	No
Lough Cutra SAC (000299)	No	No	No
Lough Gash Turlough SAC (000051)	Yes	No	Yes
Lower River Shannon SAC (002165)	Yes	Yes	No
Moneen Mountain SAC (000054)	No	No	Yes
Moyree River System SAC (000057)	No	No	Yes
Newgrove House SAC (002157)	No	No	No
Newhall And Edenvale Complex SAC (002091)	No	No	No
Old Domestic Building (Keevagh) SAC (002010)	No	No	No
Old Domestic Buildings, Rylane SAC (002314)	No	No	No
Old Farm Buildings,	No	No	No

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Ballymacrogan SAC (002245)			
Pouladatig Cave SAC (000037)	No	No	No
Poulnagordon Cave (Quin) SAC (000064)	Yes	No	No
Ratty River Cave SAC (002316)	Yes	No	No
River Shannon and River Fergus Estuaries SPA (004077)	Yes	No	Yes
Slieve Aughty Mountains SPA (004168)	No	No	No
Slieve Bernagh Bog SAC (002312)	No	No	No
Toonagh Estate SAC (002247)	No	No	No
Tullaheer Lough And Bog SAC (002343)	No	No	Yes
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

3.4.24 Shannon Estuary South Catchment

1. Deel
2. Maigue
3. Shannon embankment South
4. Maigue Outfall Scheme

Table 3-37. Deel Scheme

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Askeaton Fen Complex SAC (002279)	Yes	No	Yes
Barrigone SAC (000432)	Yes	No	No
Curraghchase Woods SAC (000174)	Yes	No	No
Glen Bog SAC (001430)	No	No	No
Lower River Shannon SAC (002165)	Yes	Yes	No
River Shannon and River Fergus Estuaries SPA (004077)	Yes	No	Yes
Stack's to Mullaghareik Mountains, west Limerick Hills and Mount Eagle SPA (004161)	Yes	No	No
Tory Hill SAC (000439)	Yes	No	Yes
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

Table 3-38. Mague Scheme

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Askeaton Fen Complex SAC (002279)	Yes	No	Yes
Barrigone SAC (000432)	Yes	No	No
Curraghchase Woods SAC (000174)	Yes	No	No
Glen Bog SAC (001430)	No	No	No
Lower River Shannon SAC (002165)	Yes	Yes	No
River Shannon and River Fergus Estuaries SPA (004077)	Yes	No	Yes
Stack's to Mullaghareik Mountains, west Limerick Hills and Mount Eagle SPA (004161)	Yes	No	No
Tory Hill SAC (000439)	Yes	No	Yes
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

Table 3-39. Shannon Embankment South

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Askeaton Fen Complex SAC (002279)	Yes	No	Yes
Barrigone SAC (000432)	Yes	No	No
Curraghchase Woods SAC (000174)	Yes	No	No
Glen Bog SAC (001430)	No	No	No
Lower River Shannon SAC (002165)	Yes	Yes	No
River Shannon and River Fergus Estuaries SPA (004077)	Yes	No	Yes
Stack's to Mullaghareik Mountains, west Limerick Hills and Mount Eagle SPA (004161)	Yes	No	No
Tory Hill SAC (000439)	Yes	No	Yes
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

Table 3-40. Maigne outfall

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Askeaton Fen Complex SAC (002279)	Yes	No	Yes
Ballyhoura Mountains SAC (002036)	No	No	No
Barrigone SAC (000432)	No	No	No
Curraghchase Woods SAC (000174)	Yes	No	No
Glen Bog SAC (001430)	No	No	No
Lower River Shannon SAC (002165)	Yes	Yes	No
River Shannon and River Fergus Estuaries SPA (004077)	Yes	No	Yes
Stack's to Mullaghareik Mountains, west Limerick Hills and Mount Eagle SPA (004161)	No	No	No
Tory Hill SAC (000439)	Yes	No	Yes
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

3.4.25 Sligo Bay and Drowse Catchment

Table 3-41. Bonet Scheme

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Arroo Mountain SAC (001403)	Yes	No	Yes
Aughris Head SPA (004133)	No	No	No
Ballintemple and Ballygilgan SPA (004234)	No	No	No
Ballysadare Bay SAC (000622)	Yes	No	Yes
Ballysadare Bay SPA (004129)	Yes	No	Yes
Ben Bulbin, Gleniff And Glenade Complex SAC (000623)	Yes	No	Yes
Boleybrack Mountain SAC (002032)	Yes	No	No
Bricklieve Mountains & Keishcorran SAC (001656)	Yes	No	No
Bunduff Lough And Machair/Trawalua/Mullaghmore SAC (000625)	Yes	No	Yes
Cloonakillina Lough SAC (001899)	No	No	Yes
Cummeen Strand SPA (004035)	Yes	No	Yes
Cummeen Strand/Drumcliff Bay (Sligo Bay) SAC (000627)	Yes	No	Yes
Doocastle Turlough SAC (000492)	No	No	No
Drumcliff Bay SPA (004013)	Yes	No	Yes
Flughany Bog SAC (000497)	No	No	Yes
Glenade Lough SAC (001919)	Yes	No	No
Knockalongy And Knockachree Cliffs SAC (001669)	No	No	No
Lough Arrow SAC (001673)	Yes	No	No
Lough Arrow SPA (004050)	Yes	No	Yes
Lough Gill SAC (001976)	Yes	No	No
Ox Mountains Bogs SAC (002006)	No	No	Yes
Sligo/Leitrim Uplands SPA (004187)	Yes	No	No
Streedagh Point Dunes SAC (001680)	No	No	Yes
Templehouse And Cloonacleigha Loughs SAC (000636)	Yes	No	No
Turloughmore (Sligo) SAC (000637)	No	No	No
Union Wood SAC (000638)	Yes	No	No
Unshin River SAC (001898)	Yes	No	No

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

3.4.26 Suir catchment

Table 3-42. Carrick-on-Suir Scheme

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Anglesey Road SAC (002125)	No	No	No
Comeragh Mountains SAC (001952)	Yes	No	Yes
Galtee Mountains SAC (000646)	No	No	No
Hugginstown Fen SAC (000404)	Yes	No	Yes
Kilduff, Devilsbit Mountain SAC (000934)	No	No	No
Lower River Suir SAC (002137)	Yes	Yes	Yes
Moanour Mountain SAC (002257)	No	No	No
Nier Valley Woodlands SAC (000668)	Yes	No	No
River Barrow And River Nore SAC (002162)	No	Yes	Yes
Slievefelim to Silvermines Mountains SPA (004165)	No	No	No
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		Yes	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

3.4.27 Tralee Bay - Feale Catchment

Table 3-43. Feale Scheme

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Akeragh, Banna And Barrow Harbour SAC (000332)	Yes	No	Yes
Ballyseedy Wood SAC (002112)	Yes	No	No
Dingle Peninsula SPA (004153)	No	No	No
Kerry Head SPA (004189)	Yes	No	No
Lower River Shannon SAC (002165)	Yes	Yes	No
Magharee Islands SPA (004125)	No	No	No
Moanveanlagh Bog SAC (002351)	Yes	No	Yes
Mount Brandon SAC (000375)	No	Yes	No
Slieve Mish Mountains SAC (002185)	Yes	No	No
Stack's to Mullaghareik Mountains, west Limerick Hills and Mount Eagle SPA (004161)	Yes	No	No
Tralee Bay And Magharees Peninsula, West To Cloghane SAC (002070)	Yes	No	Yes
Tralee Bay Complex SPA (004188)	Yes	No	Yes
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		Yes	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

3.4.28 Upper Shannon (E) Catchment

1. Ballyglass (Knockcrohery) Scheme
2. Inny Arterial Drainage Scheme (Assessment table located in section 0 as crosses into Upper Shannon (F) catchment)

Table 3-44. Ballyglass (Knockcrohery) Scheme

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Ballinturly Turlough SAC (000588)	Yes	No	No
Carn Park Bog SAC (002336)	No	No	Yes
Corbo Bog SAC (002349)	Yes	No	Yes
Fortwilliam Turlough SAC (000448)	Yes	No	No
Lough Ree SAC (000440)	Yes	No	Yes
Lough Ree SPA (004064)	Yes	No	Yes
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		No	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

3.4.29 Upper Shannon (F)

Table 3-45. Inny Scheme

Natura 2000 Sites within hydrological catchment of scheme	Natura 2000 site within 15kms radius of scheme	Freshwater pearl mussel a Qualifying Interest of this Natura 2000 site	Groundwater dependant terrestrial ecosystem present within this Natura 2000 site
Akeragh, Banna And Barrow Harbour SAC (000332)	Yes	No	Yes
Ballyseedy Wood SAC (002112)	Yes	No	No
Dingle Peninsula SPA (004153)	No	No	No
Kerry Head SPA (004189)	Yes	No	No
Lower River Shannon SAC (002165)	Yes	Yes	No
Magharee Islands SPA (004125)	No	No	No
Moanveanlagh Bog SAC (002351)	Yes	No	Yes
Mount Brandon SAC (000375)	No	Yes	No
Slieve Mish Mountains SAC (002185)	Yes	No	No
Stack's to Mullaghareik Mountains, west Limerick Hills and Mount Eagle SPA (004161)	Yes	No	No
Tralee Bay And Magharees Peninsula, West To Cloghane SAC (002070)	Yes	No	Yes
Tralee Bay Complex SPA (004188)	Yes	No	Yes
Other Criteria			
Freshwater pearl mussel sensitive area located within 3 km upriver or 35 km downriver of this scheme		Yes	
Groundwater dependent terrestrial ecosystem present within zone of influence of works			Yes

3.5 Natura 2000 Sites included in Screening

A total of 45 different schemes were assessed on the screening criteria and 44 of these schemes have the potential to impact Natura 2000 sites. The only scheme that does not have the potential to impact a Natura 2000 site is the arterial drainage scheme on the Monaghan Blackwater.

All currently designated Natura 2000 sites in Ireland were examined in the original dataset. Of these the following is a summary of the Natura 2000 sites screened in. Drainage maintenance activities have the potential to impact 321 Natura 2000 sites, as they fall within one or more of the screening criteria. Screening criteria includes Natura 2000 sites that are located within the surface and groundwater catchment of a scheme, Natura 2000 sites that contain a Ground Water Dependant Terrestrial Ecosystem, Natura 2000 sites that are within 15 km of a scheme and Natura 2000 sites that contain freshwater pearl mussel as a qualifying interest. Of these sites, 321 are included as they are in the same hydrological catchment as the schemes, 147 are included because they are within the same hydrological catchment of a scheme and also contain a GWDTE, 227 are within 15 km of a scheme and 13 sites contain have FWPM as a Qualifying Interest.

Natura 2000 sites that were included in this screening assessment, their relevant schemes and the criteria under which they were screened in or out are given in Appendix A.

3.5.1 Qualifying Interests

The qualifying interests for the Natura 2000 sites that were screened in are provided in Table 3-46. Designated habitat types within screened in SACs to Table 3-48. Designated bird species within screened in SPAs, and thus have potential to be affected by the proposed arterial drainage maintenance programme.

Within the relevant screened in Natura 2000 sites, there are 59 designated habitat types (Table 3-46. Designated habitat types within screened in SACs), 25 protected species within SACs (Table 3-47), and 65 protected bird species within SPAs (Table 3-48. Designated bird species within screened in SPAs).

Table 3-46. Designated habitat types within screened in SACs

Code	Habitat description	Habitat present within SAC located 15kms from proposed scheme
91E0	Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (Alno-Padion, Alnion incanae, Salicion albae)	Yes
21A0	Machairs (* in Ireland)	Yes
91D0	Bog woodland	Yes
91A0	Old sessile oak woods with <i>Ilex</i> and <i>Blechnum</i> in the British Isles	Yes
91J0	<i>Taxus baccata</i> woods of the British Isles	Yes
1110	Sandbanks which are slightly covered by sea water all the time	Yes
1130	Estuaries	Yes
1140	Mudflats and sandflats not covered by seawater at low tide	Yes
1150	Coastal lagoons	Yes
1160	Large shallow inlets and bays	Yes
1170	Reefs	Yes
1210	Annual vegetation of drift lines	Yes
1220	Perennial vegetation of stony banks	Yes
1230	Vegetated sea cliffs of the Atlantic and Baltic coasts	Yes
1310	<i>Salicornia</i> and other annuals colonising mud and sand	Yes
1320	<i>Spartina</i> swards (<i>Spartinion maritimae</i>)	Yes
1330	Atlantic salt meadows (<i>Glauco-Puccinellietalia maritimae</i>)	Yes
1410	Mediterranean salt meadows (<i>Juncetalia maritimi</i>)	Yes
1420	Mediterranean and thermo-Atlantic halophilous scrubs (<i>Sarcocornetea fruticosi</i>)	Yes
2110	Embryonic shifting dunes	Yes
2120	Shifting dunes along the shoreline with <i>Ammophila arenaria</i> (white dunes)	Yes
2130	Fixed coastal dunes with herbaceous vegetation (grey dunes)	Yes
2150	Atlantic decalcified fixed dunes (<i>Calluno-Ulicetea</i>)	Yes
2170	Dunes with <i>Salix repens</i> ssp. <i>argentea</i> (<i>Salicion arenariae</i>)	Yes
2190	Humid dune slacks	Yes
3110	Oligotrophic waters containing very few minerals of sandy plains (<i>Littorelletalia uniflorae</i>)	Yes
3130	Oligotrophic to mesotrophic standing waters with vegetation of the <i>Littorelletea uniflorae</i> and/or <i>Isoeto-Nanojuncetea</i>	Yes
3140	Hard oligo-mesotrophic waters with benthic vegetation of <i>Chara</i> spp.	Yes
3150	Natural eutrophic lakes with <i>Magnopotamion</i> or <i>Hydrocharition</i> - type vegetation	Yes
3160	Natural dystrophic lakes and ponds	Yes
3180	Turloughs	Yes
3260	Water courses of plain to montane levels with the <i>Ranunculion fluitantis</i> and <i>Callitriche-Batrachion</i> vegetation	Yes
3270	Rivers with muddy banks with <i>Chenopodion rubri</i> p.p.	Yes

Code	Habitat description	Habitat present within SAC located 15kms from proposed scheme
	and Bidention p.p. vegetation	
4010	Northern Atlantic wet heaths with <i>Erica tetralix</i>	Yes
4030	European dry heaths	Yes
4060	Alpine and Boreal heaths	Yes
5130	<i>Juniperus communis</i> formations on heaths or calcareous grasslands	Yes
6130	Calaminarian grasslands of the <i>Violetalia calaminariae</i>	Yes
6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates (<i>Festuco-Brometalia</i>) (* important orchid sites)	Yes
6230	Species-rich <i>Nardus</i> grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe)	Yes
6410	<i>Molinia</i> meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinion caeruleae</i>)	Yes
6430	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels	Yes
6510	Lowland hay meadows (<i>Alopecurus pratensis</i> , <i>Sanguisorba officinalis</i>)	Yes
7110	Active raised bogs	Yes
7120	Degraded raised bogs still capable of natural regeneration	Yes
7130	Blanket bogs (* if active bog)	Yes
7140	Transition mires and quaking bogs	Yes
7150	Depressions on peat substrates of the <i>Rhynchosporion</i>	Yes
7210	Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davallianae</i>	Yes
7220	Petrifying springs with tufa formation (<i>Cratoneurion</i>)	Yes
7230	Alkaline fens	Yes
8110	Siliceous scree of the montane to snow levels (<i>Androsacetalia alpinae</i> and <i>Galeopsietalia ladani</i>)	Yes
8120	Calcareous and calcshist screes of the montane to alpine levels (<i>Thlaspietalia rotundifolii</i>)	Yes
8210	Calcareous rocky slopes with chasmophytic vegetation	Yes
8220	Siliceous rocky slopes with chasmophytic vegetation	Yes
8240	Limestone pavements	Yes
8310	Caves not open to the public	Yes
8330	Submerged or partially submerged sea caves	Yes

Table 3-47. Designated species within screened in SACs

Species code	Species name	Common name	Species listed as QI for Natura 2000 site within 15kms of area of potential works
1013	<i>Vertigo geyeri</i>	Geyer's whorl snail	Yes
1014	<i>Vertigo angustior</i>	Narrow-mouthed whorl snail	Yes
1016	<i>Vertigo moulinsiana</i>	Desmoulin's whorl snail	Yes
1024	<i>Geomalacus maculosus</i>	Kerry slug	Yes
1029	<i>Margaritifera margaritifera</i>	Freshwater pearl mussel	Yes
1065	<i>Euphydryas aurinia</i>	Marsh fritillary	Yes
1092	<i>Austropotamobius pallipes</i>	White-clawed Crayfish	Yes
1095	<i>Petromyzon marinus</i>	Sea lamprey	Yes
1096	<i>Lampetra planeri</i>	Brook lamprey	Yes
1099	<i>Lampetra fluviatilis</i>	River lamprey	Yes
1103	<i>Alosa fallax fallax</i>	Twait shad	Yes
1106	<i>Salmo salar</i>	Atlantic salmon	Yes
1303	<i>Rhinolophus hipposideros</i>	Lesser horseshoe bat	Yes
1349	<i>Tursiops truncatus</i>	Common bottlenose dolphin	Yes
1351	<i>Phocoena phocoena</i>	harbour porpoise	Yes
1355	<i>Lutra lutra</i>	Otter	Yes
1364	<i>Halichoerus grypus</i>	Grey seal	Yes
1365	<i>Phoca vitulina</i>	Harbor seal	Yes
1393	<i>Drepanocladus vernicosus</i>	Slender green feather-moss	Yes
1395	<i>Petalophyllum ralfsii</i>	Petalwort	Yes
1421	<i>Trichomanes speciosum</i>	Killarney Fern	Yes
1528	<i>Saxifraga hirculus</i>	Marsh saxifrage	Yes
1833	<i>Najas flexilis</i>	Slender naiad	Yes
1990	<i>Margaritifera durrovensis</i>	Nore freshwater pearl mussel	Yes
5046	<i>Alosa fallax killarnensis</i>	Killarney shad	Yes

Table 3-48. Designated bird species within screened in SPAs

Code	Habitat description
Arctic Tern	<i>Sterna paradisaea</i>
Barnacle Goose	<i>Branta leucopsis</i>
Bar-tailed Godwit	<i>Limosa lapponica</i>
Bewick's Swan	<i>Cygnus columbianus</i>
Black-headed Gull	<i>Chroicocephalus ridibundus</i>
Black-tailed Godwit	<i>Limosa limosa</i>
Chough	<i>Pyrrhocorax pyrrhocorax</i>
Common Gull	<i>Larus canus</i>
Common Scoter	<i>Melanitta nigra</i>
Common Tern	<i>Sterna hirundo</i>
Coot	<i>Fulica atra</i>
Cormorant	<i>Phalacrocorax carbo</i>
Corncrake	<i>Crex crex</i>
Curlew	<i>Numenius arquata</i>
Dunlin	<i>Calidris alpina</i>
Dunlin	<i>Calidris alpina schinzii</i>
Eider	<i>Somateria mollissima</i>
Fulmar	<i>Fulmarus glacialis</i>
Gadwall	<i>Anas strepera</i>
Gannet	<i>Morus bassanus</i>
Golden Plover	<i>Pluvialis apricaria</i>
Goldeneye	<i>Bucephala clangula</i>
Great Crested Grebe	<i>Podiceps cristatus</i>
Great Northern Diver	<i>Gavia immer</i>
Greenland White-fronted Goose	<i>Anser albifrons flavirostris</i>
Greenshank	<i>Tringa nebularia</i>
Grey Heron	<i>Ardea cinerea</i>
Grey Plover	<i>Pluvialis squatarola</i>
Greylag Goose	<i>Anser anser</i>
Guillemot	<i>Uria aalge</i>
Hen Harrier	<i>Circus cyaneus</i>
Herring Gull	<i>Larus argentatus</i>
Kingfisher	<i>Alcedo atthis</i>
Kittiwake	<i>Rissa tridactyla</i>
Knot	<i>Calidris canutus</i>
Lapwing	<i>Vanellus vanellus</i>
Lesser Black-backed Gull	<i>Larus fuscus</i>
Light-bellied Brent Goose	<i>Branta bernicla hrota</i>
Little Grebe	<i>Tachybaptus ruficollis</i>
Little Tern	<i>Sterna albifrons</i>
Mallard	<i>Anas platyrhynchos</i>
Merlin	<i>Falco columbarius</i>
Oystercatcher	<i>Haematopus ostralegus</i>
Peregrine	<i>Falco peregrinus</i>
Pintail	<i>Anas acuta</i>
Pochard	<i>Aythya ferina</i>

Code	Habitat description
Puffin	<i>Fratercula arctica</i>
Purple Sandpiper	<i>Calidris maritima</i>
Razorbill	<i>Alca torda</i>
Red-breasted Merganser	<i>Mergus serrator</i>
Redshank	<i>Tringa totanus</i>
Red-throated Diver	<i>Gavia stellata</i>
Ringed Plover	<i>Charadrius hiaticula</i>
Roseate Tern	<i>Sterna dougallii</i>
Sanderling	<i>Calidris alba</i>
Sandwich Tern	<i>Sterna sandvicensis</i>
Scaup	<i>Aythya marila</i>
Shag	<i>Phalacrocorax aristotelis</i>
Shelduck	<i>Tadorna tadorna</i>
Shoveler	<i>Anas clypeata</i>
Storm Petrel	<i>Hydrobates pelagicus</i>
Teal	<i>Anas crecca</i>
Tufted Duck	<i>Aythya fuligula</i>
Turnstone	<i>Arenaria interpres</i>
Whooper Swan	<i>Cygnus cygnus</i>
Wigeon	<i>Anas penelope</i>

3.5.2 Conservation objectives

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. 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.

Conservation objectives for SACs and SPAs (i.e. sites within the Natura 2000 network) are required for the habitats and species for which the sites are selected. Detailed site-specific conservation objectives have been provided for the majority of SACs and SPAs, which can be found within the Conservation Objectives document for each site on the NPWS website. Generic conservation objectives have been compiled for the remaining SAC and SPAs.

The overall aim of conservation objectives is for the maintenance or restoration of the favourable conservation conditions of the Annex I habitats and/or the Annex II species for which a SAC has been selected, under which the site-specific objectives contain more detailed attributes, measures and targets.

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.

The conservation objectives for SPAs are also to maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for SPAs, which are defined by the following list of attributes and targets;

- Population trend; Measure of percentage change and whether the long term population trend stable or increasing.
- Distribution: Number, range, timing and intensity of use of areas. There is to 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.

The conservation objective for non-breeding birds Special Conservation Interests for SPAs are as follows;

- To maintain the favourable conservation condition of the non-breeding waterbird Special Conservation Interest species listed for a SPA.
- To maintain the favourable conservation condition of the wetland habitat for a SPA as a resource for the regularly-occurring migratory waterbirds that utilise it.

The conservation objectives were considered when carrying out the AA screening process for the proposed arterial drainage maintenance programme that may potentially impact on Natura 2000 sites.

3.6 Potential impacts of Arterial Drainage

The potential impacts of arterial drainage in a general sense are outlined below. However, the level of impact is uncertain at this level of assessment and therefore sites included are those that may be potentially significantly impacts and/or where uncertainty surrounds the impacts.

The following impacts, as a result of arterial drainage maintenance activity, are considered possible:

- Impacts on Morphology
 - Channel profile
 - Channel straightening
 - Riffle-glide-pool sequence
 - Substrate
 - Riparian Zone
- Impacts on Channel Processes
 - Flow characteristics
 - Sediment transport
- Impacts on water quantity and quality

The potential impacts on ecology and Natura 2000 sites include:

- Reduction in habitat diversity & stability
- Removal of riffle-glide-pool sequence
- Habitat deterioration
- Habitat loss
- Species loss and reduction in species populations
- Habitat and species fragmentation
- Increased turbidity, suspended solids & sedimentation
- Accidental spills and pollution causing damage or loss to habitats and species
- Alterations in flow regime
- Impairment of riparian zone
- Lowering of water levels and alterations in water quantity
- Spread of non-native species
- Visual, Lighting and Noise disturbance to sensitive species

3.6.1 Cumulative Impacts

Cumulative Impacts are effects that result from incremental changes caused by other past, present or reasonably foreseeable plans or projects together with the arterial drainage works. Cumulative impacts of arterial drainage are examined at catchment level and also where there is any possible overlap between schemes and other plans and projects. There is a potential for impacts on some Natura 2000 sites, as a result of cumulative impacts from the following Plans and Projects.

3.6.1.1 National Peatland Strategy

The Strategy is required to give direction to Ireland's approach to peatland management and how to optimise the benefits derived from our vast peatland resource over the coming decades. The term 'Eco-system services' is used to describe the range of benefits that ecosystems such as peatlands provide for human well-being. Some of these are obvious and others less so. Some are traditionally recognised benefits and others are emerging. Gaining a sense of the true value and potential of our peatlands requires consideration of a wide range of issues including current and possible landuses and the implications of such uses.

The Strategy aims to address some of the issues relating to the degradation of bogs, including those that occur as part of Natura 2000 sites. Therefore, there is potential for arterial drainage maintenance activities, to impact this aim. However, there is also an opportunity for the OPW to work with NPWS and the Peatland Strategy to improve bogs.

3.6.1.2 National Biodiversity Plan

'Actions for Biodiversity 2011-2016', Ireland's 2nd National Biodiversity Plan, was launched in November 2011.

In addition to biodiversity many important ecosystems exist which provide a variety of ecosystem services which bring many benefits to society and the economy; there are four main categories:

- Provisioning services (production of food and water, etc.)
- Regulating services (e.g. the control of climate and disease)
- Supporting services (e.g. nutrient cycling and crop pollination)
- Cultural services (such as spiritual and recreational benefits)

The measures Ireland will take are presented as 102 actions under a series of 7 Strategic Objectives. Some of the actions within the plan are continuing elements of existing work and many are requirements under existing EU Directives. The objectives cover the conservation of biodiversity in the wider countryside and in the marine environment, both within and outside protected areas; the mainstreaming of biodiversity across the decision making process in the State; the strengthening of the knowledge base on biodiversity; increasing public awareness and participation; and Ireland's contribution to international biodiversity issues, including North South co-ordination on issues of common interest. This Plan offers an opportunity for the OPW to provide benefits for biodiversity including Natura 2000 sites. Target 7 and Actions specifically addresses this and is outlined here:

Target 7: Optimised benefits for biodiversity in Flood Risk Management Planning

Flooding has become an issue of widespread concern in recent years, as the frequency and severity of flood events has increased. Climate change is a factor, but ill-advised development in floodplains, the sealing of previous permeable soils by building, and the loss of natural rainfall storage through drainage of bogs and other lands accelerates runoff to rivers that can create threats to human wellbeing as well as biodiversity. Ireland will ensure that the assessment of flood risk management measures in the preparation of the Flood Risk Management Plans consider the optimisation of benefits for biodiversity through restoration of floodplains, promotion of sustainable land uses and the improvement of water retention, including the controlled flooding of certain areas where appropriate.

The Office of Public Works (OPW) carry out a range of environmental assessments relating to flood risk management in Ireland including SEAs, EIAs, assessments under Article 6 of the Habitats Directive, and specific Ecological Assessments. In addition, arterial drainage maintenance operations seek to use best practice for drainage and wildlife through the ongoing development of environmental management protocols, standard operating procedures, staff environmental training, river enhancement programmes including biodiversity monitoring and a series of published environmental research assessments in relation to designated habitats and species.

Actions

7.1 Incorporate objectives to minimise biodiversity loss and degradation of ecosystem services, and to optimise biodiversity gains, in flood risk management plans

7.2 Continue to ensure that all significant drainage, including both initial drainage and maintenance drainage, is assessed for its implications for biodiversity and particularly for wetlands

Target 16: Sufficiency, coherence, connectivity and resilience of the protected areas network substantially enhanced by 2016 and further enhanced by 2020

The OPW carry out assessments under Article 6 of the Habitats Directive in relation to Arterial Drainage Activities which aims to protect Natura 2000 sites as protected areas within the EU Natura 2000 Network and they also carry out ecological assessments for protected sites, habitats and species outside of the Natura 2000 network.

There is an opportunity for the OPW to play an important role in the Biodiversity Plan and associated actions through Flood Risk and Catchment Management Planning and also through environment and ecology assessments.

3.6.1.3 River Basin Management Plan

River Basin Management Plans (RBMP) take an integrated approach to the protection, improvement, and sustainable management of the water environment. The planning process revolves around a six -year planning cycle of action and review, in order to produce a revised RBMP.

The 1st RBMP was prepared for eight River Basin Districts (RBDs). The first cycle was valid for a six-year period from 2009-2014. The plans summarised the waterbodies that were at risk of not

achieving good status. The plans describe the results and recommends potential measures that could help the watercourses meet WFD objectives. An overview of the status of all waterbodies are presented in compliance with the requirements of the WFD.

The second cycle of River Basin Management Plans:2015-2021 are in preparation and due to be published between December 2016-June 2017, as stated in the EPA website. The districts will be changed. For the 2nd Cycle, the Eastern, South Eastern, South Western, Western and Shannon River Basin Districts will be merged to form one national River Basin District. In relation to the North Western and Neagh Bann International River Basin Districts a single administrative area will be established in the Republic of Ireland portion of these two IRBDs for the purpose of coordinating their management with authorities in Northern Ireland.

3.6.1.4 The National Catchment Flood Risk Assessment (CFRAM) Programme

The National CFRAM Programme commenced in Ireland in 2011 in order to deliver the core components of the National Flood Policy, adopted in 2004, and on the requirements of the EU 'Floods' Directive (Refer to Section 2.2.2 Flood Policy Implementation for more detail). The Irish CFRAM programme is being carried out in parallel with other similar programs across the EU. The CFRAM Programme comprises of three phases:

- The Preliminary Flood Risk Assessment (PFRA) :2011;
- The CFRAM Studies and parallel activities: 2011-2015;
- Implementation and Review: 2016 onwards.

There is potential for cumulative impacts as a result of this Plan along with arterial drainage activities. There is an opportunity for the OPW also to minimise this through environment and ecology assessments.

3.6.1.5 Forestry Management

Currently, forest cover in Ireland is 10.7% making it the least wooded country in Europe, along with the Netherlands. The average forest cover in Europe is 37% (DAFMA, 2014).

There are various national policies relevant in the context of Forest Management in the Republic of Ireland:

- The National Forestry Programme 2014-2020
- The Forest, products, and people, Ireland Forest Policy Review
- Coillte's Business Management Units (BMU) Strategic Plans and Forest Management Plans
- DAFM's, Statement of Strategy 2011-2014
- Food Harvest 2020 and Food Wise 2025
- Ireland Prioritised Action Framework (PAF) for Natura 2000

These policies and plans are in accordance with the following European Union (EU) guidelines and regulations:

- European Union Guidelines on State aid for agriculture and forestry and in rural areas 2014 to 2020 addressing in particular the Common Assessment Principles.
- Regulations (EU) No. 1305/2013 of the European Parliament and of the council on support for rural development by the European Agricultural Fund for Rural Development (EAFRD) and repealing Council Regulations (EC) no 1698/2005.

All plans have a common focus on the conservation and preservation of forests, improved biodiversity, and increased number of broadleaved forests. These plans hope to increase Ireland's forest cover by following sustainable forest management principles which promotes environmentally sound, socially beneficial and economically viable practices. These plans and programs demonstrate that there are interactions between land cover, land use and management, drainage maintenance and flood risk. Natural Flood Management (NFM) approaches consider hydrological processes across a whole catchment of a river in order to determine measures that can be used as means of flood management using natural processes. An example is the presence of forestry in

upland areas can minimise the extent and the duration of flood experienced downstream. The ability of the woodland soils to quickly absorb and store rain water is a well-known fact. Interception of rainfall by their canopies can significantly reduce the amount of rain fall that falls on the ground. They also, by their presence hold back and delay the passage of rain water to rivers and streams. The NFM approach is an example of a current evolving best practice approach.

Given that these plans aim to address sustainable forest management and the NFM approach is considered as part of these plans it is unlikely that they will have a significant negative impact in combination with the cycle of arterial drainage maintenance activity.

3.6.1.6 Coillte BAU Strategic Plans 2016-2020

Coillte's Business Area Unit (BAU) cover all of Ireland. The purpose of a BAU strategic plan is to set out plans for the forest and non-forest business that will take place in the BAU during the plan period. Coillte's aim is to develop its forests in a way that is environmentally sustainable, socially sustainable and economically sustainable.

Given that this plan aims to address sustainable forest management it is unlikely that the Coillte BAU Strategic Plans 2016-2020 will have a significant negative impact in combination with the cycle of arterial drainage maintenance activity

3.6.1.7 Draft Climate Change Sectoral Adoption Planned Flood Risk Management (2012-2019)

The Flood Risk Management Climate Change Adaptation Plan has been prepared under the remit of the National Climate Change Adaptation Framework. It sets out the policy on climate change adaptation of the OPW. The scope of the plan includes:

- A review of the existing science relating to the potential impacts of climate change on flooding.
- An outline of the potential increase in flood hazard and flood risk due to climate change.
- An overview of current areas of work in the flood risk management sector.
- A policy and actions for climate change adaptation to be pursued and applied by the OPW and other responsible Departments/Agencies in the development of flood risk management strategies and measures.

The OPW sectoral adaptation plan highlights the need for further investigations into the adaptive capacity of Arterial Drainage Schemes and Embankments. There is potential for the arterial drainage maintenance activities to impact on Natura 2000 sites in combination with this Plan given that arterial drainage channels and embankments form part of the flood schemes that are occurring in response to climate change. Further continued maintenance of arterial drainage embankments, channels and structures may squeeze or limit the adaptive capacity of Natura 2000 sites to adapt or migrate in response to climate change. In many cases these constraints, as a result of maintenance activity, could influence the conservation status of designated sites, habitats and species.

3.6.1.8 Food Harvest 2020

This plan is a strategy for the medium-term development of the agri-food (including drinks) fisheries and forestry sector for the period to 2020. It outlines the key actions needed to ensure that the sector contributes to the maximum possible extent to our export-led economic recovery and the full development of the smart economy. The targets for 2020 included increase of value added (40%), exports (42%), and primary production (33%). By 2015 the goal was to increase primary output by €700m, increase value-added by €1bn, achieve export target of €10bn, increase annual aquaculture by 10,000 Tn, and increase value by €100m (DAFF, 2011).

3.6.1.9 Food Wise 2025

Food Wise 2025 is the report of the 2025 Agri-Food Strategy Committee, where it sets out a cohesive, strategic plan for the development of agri-food sector over the next decade. The Committee has identified that opportunities will arise as a result of significant population growth and greater access to international markets. In addition, the Committee recognises that the increased pressure on global agricultural resources and the environment will offer potential further growth opportunity for the Irish agri-food and fisheries sector. While Food Harvest 2020 contained a number of detailed sectoral targets, Food Wise 2025 contain just four headline aspirations:

- Increase the value of agri-food exports by 85% (19 billion euros)
- Increase value added to the sector by 70% (13 billion euros)
- Increase the value of primary production by 65% (to 10 billion euros)
- Achieving these targets is expected to deliver a further 23,000 jobs in the Agri-food sector by 2025.

There is potential for cumulative impacts as a result of these Plans along with arterial drainage activities. This is mainly through pressures to drain lands and extend land boundaries to river edges to obtain maximum use for food production or grazing. There is an opportunity for the OPW to liaise with policy makers and land owners to address the issues of land drainage in a sustainable way.

3.6.2 Related studies

There are number of studies that are ongoing and have the potential to influence and be influenced by the Arterial Drainage Maintenance Activities (2016-2021). These are detailed below:

- Catchment-based Flood Risk Assessment and Management (CFRAM) studies
- Inland Fisheries Ireland (IFI) ongoing studies
- Environmental River Enhancement Programmes (EREPs)
- REstoring river FOR effective catchment Management (REFORM)
- HYDROFOR: Assessment of the impacts of forest operation on the ecological quality of water.
- Integrated Catchment Management (<https://www.catchments.ie/>)
- Hydro-morphology standards review

3.6.2.1 Environmental River Enhancement Programmes (EREP)

The Office of Public Works (OPW) funds projects that are being co-ordinated and managed by Inland Fisheries Ireland (IFI). The programme aims at enhancing drained salmonid rivers. Although the drainage works reduced the flooding in various areas benefitting agriculture, there were some negative impacts on fisheries, angling, and on river corridors. EREP commenced in 2008 and it involved two different approaches: capital enhancement and enhanced maintenance. These projects are carried out in a small subset of rivers within the arterial drainage river network and they focus primarily on salmonid habitats. The EREP has represented a good starting point to introduce the concept of river restoration to Ireland and address the ecological impacts of physical modification.

The EREP schemes provide opportunities for the OPW to provide enhancements for fisheries including for designated Atlantic Salmon of Natura 2000 sites. The EREPs, as projects, are also assessed under Article 6 of the Habitats Directive where required.

3.6.2.2 REstoring river FOR effective catchment Management (REFORM)

REstoring river FOR effective catchment Management (REFORM), a four-year integrated research project, grouping 26 partners from 15 countries, that addresses challenges to reach the ecological objective for rivers as required by the EU Water Framework Directive. The ecological impacts of hydromorphological modifications are poorly understood and the extent to which these impacts can be reversed lacked scientific evidence. REFORM's goal was to refine current practices and tools, as well as, improve procedures for assessing pressures, impacts, and mitigation measures with more precision and sensitivity than previously done.

The EPA Catchment Science and Management Unit is developing a fluvial geomorphological assessment tool for Irish rivers and catchments to address hydromorphological component of WFD waterbody characterisation. The proposed method will be based upon the Italian Morphological Quality Index (MQI) method, developed as part of the REFORM programme. The MQI takes a fluvial geomorphological based approach as it considers processes (e.g. sediment production, water/sediment/wood flux, river channel adjustment), along with the features that these processes create. It is a multi-scale assessment where the 'reach' scale is the basic spatial unit (1-10km). This method is composed of two sections, segmentation (to identify morphological typologies to understand how a river will behave in a certain stretch of river) and condition assessment. This

results of this assessment has the potential of benefiting the National Arterial Drainage Maintenance Activities (2016-2021) in the future.

The REFORM programme has also developed tools and guidance in relation to all aspects of hydromorphology and river restoration. The programme deliverables include guidance and case studies on how to assess, justify, design, implement and monitor river restoration projects.

3.6.2.3 Hydromorphology Standards Review

Revision of the current hydromorphology standards by the European Committee for Standardisation (CEN) is due to commence by the end of 2016. The relevant standards to be reviewed are listed below and could potentially impact upon the WFD designation and classification of Arterial Drainage Scheme catchments, channels and embankments.

- EN14614:2004 Water Quality - Guidance standard for assessing the hydro-morphological features of rivers
- EN15843:2010 Water Quality - Guidance standard for determining the degree of modification of river hydromorphology

There is an opportunity for the OPW to contribute to restoring riverine habitats and recognising their role in flood prevention by participating in river restoration projects in some rivers where it is feasible.

3.6.2.4 Assessment of the Impacts of Forest Operations on the Ecological Quality of Water (HYDROFOR)

The HYDROFOR Project was a 7-year project (2008-2014 inclusive) funded by the EPA, the Department of Agriculture, Food, and the Marine (DAFM) in partnership with researchers from the National University of Ireland, Galway (NUIG), University College Dublin (UCD), and University College Cork (UCC), assessed the relationship between conifer forests and forestry operations, and surface water quality and ecology in Irish river and lakes. The research was undertaken to build on existing knowledge base from research projects on forests and address specific knowledge gaps that inform the further development of the Water Framework Directive (WFD Directive 2000/60/EC) Programmes of Measures (POMs) relevant forest operations.

3.6.2.5 STRIVE Report: Interactions of Soil Hydrology, Land-Use and Climate Change and their impact on Soil Quality (SoilH)

The research program focused on the study of the risk posed to Irish soils, in the face of changes in land use, land management and possible shifts in climate. They assessed the key functions of soils and interactions of soil hydrology, land use, and climate change. They concluded that there was very little evidence of widespread erosion or widespread compaction of the Irish soils. The authors recommended that the EPA address rainfall extremes with consequent threats of flooding as a potential threat of soil.

3.6.2.6 Integrated Catchment Management (catchment.ie)

An EPA led portal for integrated catchment management from the EPA WFD perspective which provides resources, data, and maps available to the public. The website is educational and encourages public participation in catchment management. Groundwater dependant terrestrial ecosystems have been assessed under the WFD by the EPA and are available on this website, however, the EPA have only assessed those GWDTEs that have been determined to be "at risk" by NPWS and hence this dataset is not complete.

There is an opportunity for the OPW to liaise with the EPA in relation to soil management and catchment management to examine the potential impacts of arterial drainage activities and how these affect soils, land use and the aims of the WFD.

3.7 Conclusion

A total of 45 drainage and embankment schemes were assessed on the criteria set out for the screening process. Based on the information provided by the OPW for each scheme, 44 of these schemes have the potential to impact Natura 2000 sites.

Given the scope and scale of this assessment, 321 Natura 2000 sites were screened in as potentially being affected by the proposed arterial drainage programme. Therefore, as potential impacts to these sites and their designated features cannot be screened out, it is concluded that

the proposed programme should be brought forward to the second stage of the Appropriate Assessment process.

4 Natura Impact Statement

4.1 Introduction

This Natura Impact Statement (NIS) provides the supporting information for the competent authority to carry out a Stage 2 Appropriate Assessment for the Arterial Drainage Maintenance Activities for the 6 year Cycle - 2016-2021.

4.1.1 Background to Appropriate Assessment in the OPW

4.1.1.1 Environmental Research

The OPW have carried out a number of studies to support the assessment of Arterial Drainage Maintenance activities in relation to the Habitats Directive and also Biodiversity. The following OPW documents have been referred to as part of this NIS:

- Ryan Hanley (2014a), The Office of Public Works, Arterial Drainage Maintenance Categories, Source » Pathway » Receptor Chains for Appropriate Assessment. Prepared by Ryan Hanley Consulting, Engineers on behalf of the Office of Public Works;
- Ryan Hanley (2014b), Stage 1: Appropriate Assessment Screening Methodology for the Maintenance of Arterial Drainage Schemes. Prepared by Ryan Hanley Consulting Engineers on behalf of the Office of Public Works.
- Environmental River Enhancement Programme Annual Reports
 - Environmental River Enhancement Programme Annual Report 2015
 - Environmental River Enhancement Programme Annual Report 2014
 - Environmental River Enhancement Programme Annual Report 2013
 - Environmental River Enhancement Programme 5-Year Report 2008-2012
 - Environmental River Enhancement Programme: River Corridor Bird Monitoring Report 2014
 - Environmental River Enhancement Programme: Field Survey Methodologies 2012
- OPW Series of Ecological Impact Assessments
 - Issue No. 2 EclA Raised Bogs
 - Issue No. 3 EclA Atlantic Salmon
 - Issue No. 4 EclA Otter
 - Issue No. 5 EclA Floating River Vegetation
 - Issue No. 6 EclA Riparian Birds
 - Issue No. 7 EclA Fresh Water Pearl Mussel
 - Issue No. 8 EclA Turloughs
 - Issue No. 9 EclA 3 Lamprey Species
 - Issue No. 10 EclA White-clawed Crayfish
 - Issue No. 11 EclA Fens, Mires & Whorl Snails
 - Issue No. 12 EclA Kingfisher *Alcedo atthis* & other riparian birds II
- King, J. J., Wightman, G. D., Hanna, G. and Gilligan, N. (2015), River engineering works and lamprey ammocoetes; impacts, recovery, mitigation. Water and Environment Journal, 29: 482–488. doi:10.1111/wej.12134
- Arterial Drainage Maintenance SEA Screening Statement 2009
- Arterial Drainage Maintenance & High Risk Designation 2011-2015 Scoping 2009
- Arterial Drainage Maintenance & High Risk Channel Designation Environmental Report 2011 - 2015
- Drainage Maintenance & Channel Designation NIS Dec 2012
- Drainage Maintenance & Channel Designation Programme 2011 - 2015
- The Office of Public Works (2011) Arterial Drainage Maintenance Environmental Management Protocols & Standard Operating Procedures (Appendix A)
- Pilot Studies: The commissioning of scientific based pilot studies by the OPW on impacts of current work methods, alternative work methods and approaches to channel

maintenance, and recovery rates of environmental receptors will provide evidence regarding potential impacts and form a baseline from which management plans and specific mitigation measures can be drawn. This will also provide data that can demonstrate and validate the nature of potential impacts, their extent and efficiency of mitigation measures. GWDTEs and the potential impact posed by drainage maintenance activities is an area that requires further research.

Currently, the OPW is involved in progressing a pilot Conservation Management plan for the fen at Tory Hill SAC (000439). The continuation and expansion of this study to include other fens will provide data on potential impacts of programmes such as arterial drainage maintenance activities and highlight implications for drainage activities, as identified as additional research required in the OPW's EclA No. 11 and by O'Connor and McDonnell (2008).

Pilot studies such as this will allow for habitats and species to be studied and decisions made in relation to the extent of maintenance for statutorily maintained channels, while still achieving favourable conservation status. The current conservation status of habitats and species may be unfavourable, and thus restoration measures may be required, which will have to be reflected in the approach to channel maintenance and associated activities of the OPW.

The OPW has commissioned habitat walkover surveys along majority of their schemes in order to get a snapshot of the baseline environment in these areas. The OPW has the data available. Appendix D is an example of the survey data output available for the Deel Scheme.

4.2 Potential Impacts

As noted in the Screening for AA the following impacts during construction and operation are considered possible from arterial drainage maintenance activity:

Impacts on Morphology:

- Channel profile
- Channel straightening
- Riffle-glide-pool sequence
- Substrate
- Riparian Zone

Impacts on Channel Processes:

- Flow characteristics
- Sediment transport
- Impacts on water quantity and quality

The potential impacts on ecology and Natura 2000 sites include:

- Reduction in habitat diversity & stability
- Removal of riffle-glide-pool sequence
- Habitat deterioration
- Habitat loss
- Species loss and reduction in species populations
- Habitat and species fragmentation
- Increased turbidity, suspended solids & sedimentation
- Accidental spills and pollution causing damage or loss to habitats and species
- Alterations in flow regime
- Impairment of riparian zone
- Lowering of water levels and alterations in water quantity

4.3 Sources of Impacts

The following summary of impacts is taken from the Ryan Hanley report commissioned by the OPW (Ryan Hanley, 2014a). JBA have updated the summary in order to take into account any additional information collated during the follow-on assessments of arterial drainage maintenance activities.

There are a variety of sources pertaining to impacts which may arise from drainage maintenance activities.

These have been categorised under a number of headings as follows:

- Physical disturbance of habitats (and loss of woody vegetation cover)
- Release of suspended solids
- Spillage of hydrocarbons
- Other spillages
- Release or changes in nutrient levels
- Changes in water levels
- Noise and visual disturbance
- Light Pollution
- Vibration related disturbance

The following sections provide a description of the source of impacts arising from drainage maintenance activities and should be read in conjunction with the OPW's Environmental Management Protocols and Standard Operating Procedures, which provide a description of the protocols and operating procedures that are currently deployed to minimise, avoid or mitigate the potential source of impacts arising from drainage maintenance activities.

4.3.1 Physical Disturbance of Habitats

There is potential for impacts to Annex I habitats and supporting wetland habitats as a result of physical disturbance during drainage maintenance activities.

4.3.1.1 Access Routes and Maintenance Access Corridor (MAC)

During maintenance, a maintenance access corridor (MAC) is generally utilised along one side of a channel/embankment for maintenance purposes and to access a structure. These channels and structures are generally accessed via public roads and through farmland where possible. However, in some cases the MAC may require activities such as scrub, tree and vegetation removal that may cause impacts including on protected species using these areas. The MAC routes are used to track the hydraulic excavators for maintenance and for the disposal of spoil. The same route is generally followed every maintenance cycle. The aim of this approach is to avoid disturbance of habitats on the opposite bank during works. However, on larger rivers it may be necessary to maintain the river along both river banks. In this instance, there is potential for not only impacts from individual activities but also cumulative impacts as a result of works from both banks of the river.

Where grasslands are present within the maintenance access corridor, the disturbance of habitats is predominantly temporary as the grasslands are trampled by machinery and can recolonise post completion of the maintenance activities.

Within woodland and scrub habitats a linear path more typical of disturbed vegetation i.e. Scrub/transitional woodland (WS) will be evident along the maintenance access corridor due to regular machine access. In this regard, the disturbance regime associated with the tracking of plant machinery along the maintenance access corridors on the channel bank arrests succession to mature woodland such that Scrub/transitional woodland (WS) dominates.

The input of suspended solids to a surface water body can occur as a result of the creation of a MAC. As long periods of time can occur between maintenance cycles on a channel, scrub and immature trees can become established during that time. The removal of this vegetation may result in bare ground being exposed, as bush/tree stumps must be removed to allow machinery to track along the MAC.

During the creation of a MAC, through the removal of scrub and immature trees, this action could result in a reduction of the riparian vegetation along a surface water body. As riparian vegetation

acts as a natural buffer to watercourses, this may result in the indirect addition of nutrients to an adjacent water body via surface water runoff from adjacent land, which could contribute to the eutrophication process in areas downstream.

The removal of this vegetation may result in bare ground being exposed, as bush/tree stumps must be removed to allow machinery to track along the MAC. These exposed areas have the potential to be colonised by invasive species by being transported downstream via surface water pathways during times of high flows or via land and air pathways, as invasive species typically colonise areas of disturbed ground and may be susceptible to their establishment.

Plant machinery will utilise the same maintenance access corridor used for channel maintenance to gain access to a bridge or sluice structure. Where individual trees, woodland and scrub habitats are present at the location of the structure, these may be removed to facilitate bridge and sluice inspection and works. Where mature trees are present, these are generally avoided by plant machinery. Where such trees require removal the typical mitigating measure would be to leave tree in fallen position for 24hrs to allow any bats vacate, as outlined in SOPs (Appendix A). However, additional considerations should be taken for other impacts associated with mature tree removal, its location relative to the bank and other species that may be impacted.

4.3.1.2 Site Compounds

In relation to siting of mobile short-term staff welfare facilities, plant storage and car parking there is no requirement for physical disturbance of habitats associated within the provision of these facilities given that the facilities are provided by local landowners. Where a site compound is required and causes physical disturbance of habitats and/or species there is potential for impacts that would require assessment.

4.3.1.3 Haul Roads

Haul roads are generally not required to facilitate drainage maintenance. Where access is required in soft ground conditions, plant equipment will be brought in on tracks or temporary matting will be laid to provide a corridor for machinery access. Where matting is utilised it will be completely removed post completion of works to allow vegetation to re-establish. All plant and machinery is confined to one defined access route to minimise disturbance. There is potential for physical disturbance of Wet grassland (GS4) habitats which tend to prevail in soft ground conditions where haul roads are required.

4.3.1.4 Channel and Structural Maintenance

The removal of silt and vegetation from in-stream habitats of channels has the potential to impact on the habitat of surface water dependant Annex II species where present. Physical disturbance relates to direct mortalities, temporary habitat loss, displacement by bough waves, reduction in vegetation as a food resource and as a refuge.

In relation to Atlantic Salmon, works are undertaken outside of the salmonid spawning season (May to September) and the times that early life stages of salmonid fish will be present as per Section 173 of the Fisheries (Consolidation) Act (1959) on channels with salmonid spawning habitat. Channel maintenance also avoids spawning gravel habitat where possible.

Lamprey larval burrows are characteristically found at eddies or backwaters, on the inside of bends or behind obstructions, where current velocity is below that of the main stream and where organic material tends to accumulate (Kelly & King, 2001). They favour partially shaded areas, and the presence of aquatic plants. In this regard there is potential for channel maintenance to cause;

- Disturbance to in-stream silts and temporary removal of habitat in the form of silts/fines,
- Disturbance of spawning lamprey,
- Removal of individuals within the excavator bucket which may result in a localised impact on lamprey populations depending on recruitment rates and frequency of maintenance works.

Impacts to White-clawed Crayfish from physical disturbance are likely to reflect those of salmonids and Lamprey. Other potential species-only effects include:

- Breeding crayfish or females carrying eggs may be disturbed (King et al., 2008),
- Individuals may be displaced locally as a result of the bough-wave created by the excavator or it may induce an escape reaction resulting in a localised impact on population size,

- Removal of individuals within the excavator bucket during bed excavation works may result in a localised impact on the population size of White-clawed Crayfish (King et al., 2008).

Restrictions on timing of works may apply in relation to the presence/absence of White-clawed Crayfish and Sea, River and Brook Lamprey to minimise disturbance of habitats.

As bats can inhabit bridges there is potential for disturbance and loss of habitat to bats as a result of maintenance works on bridges. Where masonry bridges require maintenance a bat survey is undertaken by a bat specialist in advance of commencement of works to avoid impacts to bats.

4.3.1.5 Embankment Maintenance

The maintenance of embankments requires the regular mowing of the grasslands on the embankment to arrest the growth of woody vegetation. Maintenance may include the removal of woody vegetation where some time has elapsed since the last maintenance period. This activity is categorised under activity G - Mowing. There is potential for physical disturbance to habitats in terms of the loss of cover for the Annex II species Otter and birds of Special Conservation Interest where woody vegetation removal is required. In this regard the removal of woody vegetation is planned in discrete work sections to avoid fragmentation of commuting/foraging habitat for Otter and cover for birds. Embankment maintenance works may also result in the exposure of bare and un-vegetated embankments for a period of time, before being re-colonised. Un-vegetated embankments may be a source of suspended solids to an adjacent water body via surface water runoff and may also provide a potential area for colonisation of invasive plant species.

4.3.2 Release of Suspended Solids

The release of suspended solids can impact directly on surface water dependant Annex II species by blocking the respiratory organs (i.e. gills) of fish and the breathing apparatus of filter feeders e.g. Freshwater Pearl Mussel (*Margaritifera margaritifera*). In particular channel maintenance undertaken during periods of low flow, where adult salmon would be dependent on finding deep pool areas to rest up (while waiting for flood conditions to draw them further upstream), has the potential to result in the deposition of silt in downstream pools or low-velocity reaches which could cause stress to fish and may displace adult salmon down river (King, 2007). In relation to juvenile salmon, the siltation of gravels in spawning and nursery areas can adversely impact on these life stages. The potential impact is greater in low flow situations that pertain in summer – early autumn. During this time period the release of suspended solids can result in stress in juvenile salmon (King, 2007). The release of suspended solids also has the potential to impact on the quality of spawning habitats.

There is also potential for impacts on the diversity/ abundances of macro-invertebrate communities and smaller fish species which form part of the food chain of surface water dependant Annex II species due to reductions in habitat quality and water quality.

Freshwater Pearl Mussel, in particular juveniles, have low tolerances for suspended solids and unlike the majority of the aquatic species, they have limited ability to move from sections of a channel that may be subject to a pollution event, with further limitations associated with the probability of finding suitable habitat given their specific requirements. In addition to particular river profile, shade, depth and flow rates and other factors, Freshwater Pearl Mussel require clear water not saturated with small sediment particles (such as those associated with local soils) that could interfere with their ability to feed and breath via their siphons and gills. It should be noted that juvenile Freshwater Pearl Mussels are more vulnerable to fluctuation in environmental conditions than adults and have stricter requirements for survival as a result.

Increases in suspended solids may also bring about a reduction in light penetration which restricts photosynthesis, alters oxygen relationships in surface waters and may cause a shift from primary producers to primarily detritus feeders (with the exception of planktonic species or species living on floating debris). Light penetration is important not only with respect to productivity but also with respect of community composition. The Annex I habitats Hard oligotrophic/mesotrophic waters with benthic vegetation of *Chara sp.* [3140] and Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation [3150] are benthic macrophyte species. Wetzel and McGregor (1968) reported that low light intensity inhibits germination of *Najas flexilis* and *Chara sp.* and would therefore eliminate these two species from a community. There are few studies available pertaining to the potential for impacts on benthic macrophytes arising from drainage maintenance activities. It is anticipated that there is a potential for impacts on *Chara sp.* arising from the release of suspended solids.

In relation to the Annex I habitat Water courses of plain to montane levels with the *Ranunculus fluitantis* and *Callitriche-Batrachion* vegetation [3260], this vegetation community may be affected by suspended solids released from arterial drainage maintenance works as suspended solids have the potential to settle on a river bed. The deposition of fine sediments could cause a change in the composition of the river bed, thereby affecting the growth of the vegetation community associated with this Annex I habitat.

The input of suspended solids to a surface water body can occur as a result of the creation of a MAC. As long periods of time can occur between maintenance cycles on a channel, scrub and immature trees can become established during that time. The removal of this vegetation may result in bare ground being exposed, as bush/tree stumps must be removed to allow machinery to track along the MAC. Similar areas of bare soil may occur on embankments due to maintenance works. Resulting areas of bare soil are a source of suspended solids that may enter an adjacent surface water body via surface water runoff during rainfall events.

4.3.3 Hydrocarbon Spillage

The accidental release of hydrocarbons has the potential to impact directly on surface water dependant Annex II species and other species by poisoning, by blocking the respiratory organs (i.e. gills) of fish and the breathing apparatus of filter feeders. A large scale pollution event could result in a severe impact.

Hydrocarbons could also damage the respiratory organs and irritate and cause ulcerations on the skin of fish, amongst other impacts. Impacts arising from the accidental spillage or release of hydrocarbons and other chemicals could result in a slight to moderate negative impact on the Annex I habitat Water courses of plain to montage levels with the Granulation annuitants and Non-theatrical vegetation [3260]. This Annex I habitat provides a micro-habitat e.g. shade, shelter and a food source for an array of aquatic species; therefore, the food chain of salmonids and other species could also be indirectly affected.

All plant and machinery are regularly maintained and serviced to minimise release of hydrocarbons. All hydraulic excavators and other plant machinery use long life engine oil and biodegradable hydraulic oil. Fuelling and lubrication are conducted a minimum of 50m away from all channels. Spill kits are present in all plant machinery used in maintenance activities. Integrated submersible pumps are also deployed in the event of structural maintenance and the requirement for de-watering of excavations. Used engine oil and hydraulic oil is disposed of by a licensed waste handler.

4.3.4 Other Spillages

The accidental spillage of grout, concrete and sealants during works could impact directly on water dependant fish and invertebrate species by blocking the respiratory organs (i.e. gills) of fish and the breathing apparatus of filter feeders. Concrete fines could also damage the respiratory organs and irritate and cause ulcerations on the skin of fish, amongst other impacts by changing the physiochemical properties of the water. It should be noted that the risk of a significant concrete, grout and sealant spillage is considered unlikely. Grout, concrete and sealants utilised during the repair and maintenance of structures are handled in accordance with the relevant material safety data sheet. Spillages or inappropriate disposal of disinfectants used for biosecurity measures when working with invasive species could also accidentally enter the aquatic system.

4.3.5 Release of nutrients/changes in nutrient levels

During channel maintenance there is potential for localised soil enrichment or changes in pH due to the disposal of spoil, in the form of silt and vegetation, which is spread thinly along the bank or on top of existing spoil heaps where present within the access corridor. There is also potential for localised soil enrichment from dead wood material, and mulch where the arisings are left on site to decompose or where mulched material is buried. Where excess nutrients enter surface waters there is potential for localised enrichment of channels.

During the removal of in-stream silts and vegetation and bank protection works there is potential for mobile inorganics N03 and low mobility inorganics P04 to be released from the channel bed which could result in eutrophication in channels and downstream surface water bodies and a reduction in ability to support Annex II species and Annex I habitats. There is also potential for karst and other

groundwater systems to act as pathways of and receptors to nutrients. This may also affect Groundwater Dependent Terrestrial Ecosystems.

As mentioned above, during the creation of a MAC, through the removal of scrub and immature trees, this action could result in a reduction of the riparian vegetation along a surface water body. As riparian vegetation acts as a natural buffer to watercourses, this may result in the indirect addition of nutrients to an adjacent water body via surface water runoff from adjacent land, which could contribute to the eutrophication process in areas downstream.

There is also a requirement for water supply and disposal of wastewater from the welfare facilities. There is no potential for impacts via the release of nutrients as all mobile site facilities are maintained by a licensed waste handler.

4.3.6 Changes in Water Levels

Changes in water levels can occur as a result of drainage maintenance activities occurring upstream or downstream of surface water dependant Annex I habitats or supporting wetland habitats. Changes in water levels can impact marginal habitats of a channel due to drainage activities. These activities increase conveyance, which can cause upstream water levels to decrease and downstream levels to increase. This may impact habitats that require a certain amount of inundation and other natural resource supply. Lowering of water levels may also impact species such as lamprey, as an increased channel margin could expose river sediments in which they burrow.

Changes in water levels can also occur as a result of drainage maintenance activities down-gradient or up-gradient of groundwater dependant habitats, depending on the typology of the groundwater dependant habitat and the type of groundwater body. In particular, this may affect Groundwater Dependent Terrestrial Ecosystems that rely on groundwater quantity such as fens, bogs and their associated habitats and species.

4.3.7 Noise and Visual Disturbance

The types of machinery typically utilised during maintenance works include 3600 hydraulic excavators (from 15 up to 20 tonne excavators), mini-diggers, tractors and trailers, tipper lorries, hydraulic shears, hydraulic secateurs, chainsaw, mulchers and mowers. The removal of heavy in-stream silt and vegetation requires the use of a hydraulic excavator with a 1.5m wide (approximate) bucket (capacity approximate 500ltrs). For standard excavators, works progress at a rate of 700m to 900m per week. In relation to long-reach excavators, works progress at a slower rate of between 200m and 350m per week. Rates may change due to channel width or ground conditions.

Typically, there is one machine working on a channel which is powered down when not in use. However, the potential impact varies in terms of sensitivities of the ecological receptors that inhabit riparian habitat and watercourses, such as Otter, Kingfisher, fisheries etc. Buffer distances relating to the potential for significant effects arising from noise and visual disturbances on Annex II, IV and V species and Article 12 bird species are detailed in Ryan Hanley (2014b).

4.3.8 Light Pollution

With regards to likely significant effects arising from light pollution during drainage maintenance activities it should be noted that all maintenance activities are undertaken during daylight hours. Standard working hours are 8.00am to 4.30pm Monday to Friday. In this regard, there is no requirement for temporary site lighting to facilitate works. Therefore, in the absence of a complete source » pathway » receptor chain there is no potential for likely significant effects arising from drainage maintenance activities from light pollution.

4.3.9 Vibration Related Disturbance

There is potential for vibration related impacts to bats species, otter and other species that use bridges including upstream and downstream.

4.4 Impact Assessment

4.4.1 Potential Impacts of the Programme Alone

The arterial drainage maintenance programme has the potential to cause impacts via the following pathways; surface water, land and air, and groundwater. Table 4-1 summaries the impact per activity, based on Ryan Hanley (2014b). Ryan Hanley omitted activities D (Bush cutting/ branch trimming), E (Tree cutting) and G (Mowing) under surface water pathways, however given the points

raised in Sections 4.3.2 and 4.3.5 above, these activities are considered in Table 4-1 due to their potential to result in un-vegetated areas and bare soil that may be a source of suspended solids, nutrients that could enter an adjacent surface water body via surface water runoff during rainfall events. It could also leave an exposed area for colonisation by invasives.

The potential impacts posed by the arterial drainage maintenance programme have the potential to negatively impact annexed habitats and species under the Birds and Habitats Directives, which are qualifying interests of Natura 2000 sites. Due to the wide geographical scope of this assessment and the generic description of work activities at this scale, it is not possible to identify specific potential impacts to annexed habitats and species during this assessment.

However, it is possible to ascertain that the proposed programme will result in works being conducted within and immediately adjacent to Natura 2000 sites and have the potential to cause impacts such as disturbance to key species, habitat or species fragmentation and changes in key indicators of conservation value such as water quality.

In addition, due to the scope of this assessment, the precautionary approach has been taken in the identification of potential impacts, for example, the identification of potential impacts via land and air pathways for the installation of gates. Although the installation of gates is not anticipated to cause a significant disturbance, the precautionary approach is required as potential locations relevant to Natura 2000 sites are not known. Similarly, the activity of Mulching (activity F) is usually carried out in association with activities D, E and G, if woody vegetation removal is required. Although no potential is anticipated from the activity of Mulching, the presence of the machinery required to carry out this task and the access route to site may cause a potential disturbance impact via land and air pathways.

Although it is not possible to assess the schemes at project level for this NIS, it is possible to comment in more general terms on the potential impacts and also to make recommendations on how these may be addressed.

It is also noted that specific Screenings for AA and Natura Impact Statements have been completed at project level for a number of the schemes and some of the experiences and outcomes of those assessments have been considered within this higher level assessment.

Table 4-1: Drainage maintenance activities and potential impacts

Activity	Pathway	Receptor	Potential Impacts
A - Silt and vegetation management	Surface water	Surface water dependant Annex I species and Annex II habitats	Increased turbidity, suspended solids and sedimentation Increased nutrients Changes in channel morphology Lowering of water levels Alteration of flow regime - removal of riffle-pool sequences
	Land and Air	Annex I habitats Annex I, II and IV species Article 12 bird species and supporting wetlands	Reduction in habitat diversity Habitat deterioration and loss Species disturbance, displacement and possible loss
	Groundwater	Groundwater dependant habitats such as petrifying springs, turloughs, fens and bogs Groundwater dependant species such as Geyer's whorl snail and Yellow Marsh Saxifrage Groundwater bodies with connectivity to the surface water body being maintained	Habitat deterioration and loss Species disturbance, displacement and possible loss Impacts on water quantity and quality
B - Aquatic vegetation cutting	Surface water	Surface water dependant Annex I species and Annex II habitats	Alteration of water levels and alterations in water quantity
	Land and Air	Annex I habitats Annex I, II and IV species Article 12 bird species and supporting wetlands	Reduction in habitat diversity Habitat deterioration and loss Species displacement and possible loss
	Groundwater	NA	NA
C - Bank protection	Surface water	Surface water dependant Annex I species and Annex II habitats	Increased turbidity, suspended solids and sedimentation Increased nutrients Alteration of flow regime at or downstream of the proposed works Changes in channel morphology
	Land and Air	Annex I habitats Annex I, II and IV species Article 12 bird species and supporting wetlands	Reduction in habitat diversity Habitat deterioration and loss Species displacement and possible loss
	Groundwater	Groundwater dependant habitats such as petrifying springs, turloughs, fens and bogs Groundwater dependant species such as Geyer's whorl snail and Yellow Marsh Saxifrage	Habitat deterioration and loss Species displacement and possible loss Impacts on water quantity and quality

Activity	Pathway	Receptor	Potential Impacts
		Groundwater bodies with connectivity to the surface water body being maintained	Changes in connectivity from Groundwater to surface waters
D - Bush cutting/ branch trimming	Surface water (indirect via surface water runoff)	Surface water dependant Annex I species and Annex II habitats	Increased turbidity, suspended solids and sedimentation Increased nutrients
	Land and Air	Annex I habitats Annex I, II and IV species Article 12 bird species and supporting wetlands	Impairment of riparian zone Reduction in habitat diversity Habitat deterioration and loss Species disturbance, displacement and possible loss
	Groundwater	NA	NA
E - Tree cutting	Surface water (indirect via surface water runoff)	Surface water dependant Annex I species and Annex II habitats	Increased turbidity, suspended solids and sedimentation Increased nutrients
	Land and Air	Annex I habitats Annex I, II and IV species Article 12 bird species and supporting wetlands	Impairment of riparian zone Reduction in habitat diversity Habitat deterioration and loss Species disturbance, displacement and possible loss
	Groundwater	NA	NA
F - mulching	Surface water	NA	NA
	Land and Air	Annex I habitats Annex I, II and IV species Article 12 bird species and supporting wetlands	Please see activities D and E for potential impacts
	Groundwater	NA	NA
G - Mowing	Surface water (indirect via surface water runoff)	Surface water dependant Annex I species and Annex II habitats	Increased turbidity, suspended solids and sedimentation Increased nutrients
	Land and Air	Annex I habitats Annex I, II and IV species Article 12 bird species and supporting wetlands	Impairment of riparian zone Reduction in habitat diversity Habitat deterioration and loss Species disturbance, displacement and possible loss
	Groundwater	NA	NA
H - Gate installation	Surface water	NA	NA

Activity	Pathway	Receptor	Potential Impacts
	Land and Air	Annex I habitats Annex I, II and IV species Article 12 bird species and supporting wetlands	Reduction in habitat diversity Habitat deterioration and loss Species displacement and possible loss
	Groundwater	NA	NA
I - Sluice maintenance	Surface water	Surface water dependant Annex I species and Annex II habitats	Increased turbidity, suspended solids and sedimentation Increased nutrients Lowering of water levels Alteration of flow regime at or downstream of the proposed works
	Land and Air	Annex I habitats Annex I, II and IV species Article 12 bird species and supporting wetlands	Reduction in habitat diversity Habitat deterioration and loss Species displacement and possible loss
	Groundwater	NA	NA
J - Bridge maintenance	Surface water	Surface water dependant Annex I species and Annex II habitats	Increased turbidity, suspended solids and sedimentation Increased nutrients Lowering of water levels Alteration of flow regime at or downstream of the proposed works
	Land and Air	Annex I habitats Annex I, II and IV species Article 12 bird species and supporting wetlands	Reduction in habitat diversity Habitat deterioration and loss Species disturbance, displacement and possible loss
	Groundwater	NA	NA

4.4.2 Potential Impacts of the Programme In-Combination

Many of the plans and policies detailed in Section 3.6.1 offer the OPW the opportunity to participate in catchment led initiatives, in particular regarding flood risk management, and in the enhancement and restoration of the riverine environment and designated habitats and species of Natura 2000 sites.

4.4.2.1 Peatland Strategy

However, the proposed arterial drainage maintenance programme has the potential to pose conflicting objectives to the Peatland Strategy, as the aim of the OPW's programme will be to maintain drainage of these areas or the adjoining and adjacent lands. The OPW should work with the Peatland Strategy and NPWS to adapt their working methods within the zone of influence of bogs to ensure not compromising their conservation status and any restoration measures that may be implemented to improve their condition. This should include an overall structured approach and list of actions within an integrated Plan, in addition to the current pilot studies that have been undertaken. The actions of the plan should aim to help the OPW to understand how they can actively address areas of conflict with the Peatland Strategy outside of pilot studies. This requires a more holistic view of how catchments and flooding can be managed along with other land management practices.

4.4.2.2 Land Management and Climate Change

The proposed programme also has the potential to cause negative in-combination effects to Natura 2000 sites in combination with land drainage issues regarding climate change and primary production of the agri-food sector. This also links in with climate change and the OPW's adaptive capacity of their proposed programme as arterial drainage forms an element of flood schemes, which are being implemented in response to climate change.

Land drainage may come under more pressure in future climate change scenarios, where increased rainfall and lack of evaporation of moisture from the soils results in wetter farmlands and soils throughout the year. This additional pressure, may not be alleviated by increased arterial drainage activities and may require new approach to how land is managed and drained in the future.

4.4.3 Potential Measures to Avoid Adverse Effects

In order to ensure compliance with the Birds and Habitats Directive and to ensure no significant impact upon Natura 2000 sites and their designated habitats and species, proposed arterial drainage maintenance activity should undergo an Appropriate Assessment at project level, based on final project design or the specifics of the programme elements, which should include the size, scale, extent and duration of works. The hydraulic, hydrological and hydrogeological impacts resulting from the proposed works at project level should also be considered in the Appropriate Assessment.

The Appropriate Assessment should also examine in-combination effects with plans and projects, such as those outlined in this assessment. The proposed project level drainage activities should not pose in-combination effects with other plans and projects, and if so, should be accounted for in the project design, working methods, extent of works and mitigated appropriately if necessary.

To date, NISs have been carried out for the proposed arterial drainage maintenance programme for the following schemes;

- Boyne
- Duleek
- Hazelhatch
- Maine
- Moy
- Ryewater
- Embankments at Blanket Nook, the Maine and the Feale

NISs were also prepared for the following schemes in 2014;

- Corrib
- Duff
- Inny
- Kilcoo
- Killimor

AA Screening reports have been conducted for EREP projects on the following rivers;

- Boyne
- Trimoge
- Stirabout
- Grange
- Yellow
- Abbey

4.5 Mitigation and Recommendations

This assessment offers the OPW potential to review and improve upon their current work programme and activities, but also to further investigate areas that may also improve and enhance species and habitat diversity within and adjacent to Natura 2000 sites.

Given the geographical scope of this assessment and the generic description of work activities at this scale, it is not possible to identify specific potential impacts on Natura 2000 sites and their qualifying interests.

The following measures should be incorporated into the overall approach to the Programme of activities. These can be applied to every cycle thereafter and updated or improved when necessary. These are based upon JBA's experience working on projects over recent years and take into account previous comments from NPWS. As the OPW have relied on SOPs and the Environment Management Research projects to date, these have been very helpful in mitigating potential impacts, however these require updating. The OPW should consider the following measures regarding their proposed arterial drainage maintenance programme:

1. The OPW SOPs require updating in relation to details of working methods and mitigation measures detailed therein. This may be done through the revision of the SOPs, or the provision of method statements to supplement the SOPs. Mitigation measures should be site specific and should not only rely on the contribution of bodies such as Inland Fisheries Ireland and National Parks and Wildlife Service. This will provide the OPW with the opportunity to improve the demonstration of their responsibility and compliance under the Birds and Habitats Directive through establishing more detailed working procedures. For example, the current SOP for otter details the avoidance of areas of dense scrub and undergrowth. However, the feasibility of this in practice may not be achievable as it is often areas of overgrowth that need to be removed through the maintenance of areas such as the machine access corridor or those causing obstruction to water flow.
2. The updating of the OPW SOPs should consider the inclusion of the assessment of the potential impacts (not identified in SOPs) that working methods within the riverine corridor may have on adjacent watercourses in relation to the release of suspended solids through activities such as tree cutting, tree removal, bush cutting and the maintenance of MACs.
3. The OPW should include a detailed and quality controlled method statement within an updated SOPs for the management of invasive species. If avoidance of areas containing invasive species is not possible, specific biosecurity and mitigation measures are required to be in place for the removal, treatment and management of invasive species, when they are encountered on embankments, along river banks or within drainage channels. A protocol for the disinfection, appropriate cleaning of equipment and the disposal of disinfectants should be implemented. JBA have noted that some of the OPW protocols for invasives species are either absent or outdated in SOPs.
4. As the mitigation measures of Appropriate Assessment reports currently rely heavily on the OPW's SOPs, which are supplemented with additional mitigation measures where required,

these assessments will need to be revised when an updated version of the SOPs are made available.

5. Overall the update of SOPs requires experienced technical scientists and suitably qualified ecologists to provide input for the updates and consultation with IFI and NPWS.
6. The SOPs should undergo monitoring to examine the success of their implementation. This could be done over a number of years at particularly sensitive sites such as Natura 2000 sites.
7. The Source-Pathway (Ryan-Hanley, 2014a) and Screening Methodology (Ryan-Hanley, 2014b) methods should be updated also. Some examples include: impacts from the embankment activities and tree and bush cutting activities as indirect sources of suspended solids via surface water pathways. Bush cutting, which involves the maintenance of the MAC, should also be included as an indirect source of sediments and nutrients to an adjacent waterbody and a threat to the spread of invasives. The update will look at all potential impacts posed to Natura 2000 sites to ensure they are addressed, thereby ensuring a comprehensive identification and evaluation of potential impacts during the Appropriate Assessment process.
8. OPW currently carry out an Environmental River Enhancement Programme in conjunction with Inland Fisheries Ireland (IFI). IFI monitor the physical habitat and biological elements pre and post works in order to assess the effectiveness of such works on the river corridor biodiversity and hydromorphology. The findings of this monitoring regarding elements such as the recovery time of biotic elements such as instream vegetation, crayfish and lamprey, and river corridor biodiversity. Actions to be taken as a result of the outcomes of monitoring should be identified and the actions undertaken.
9. OPW monitoring programmes are useful in assessing the success of enhancement programmes and restoration projects. Monitoring should be seen as an iterative process with updates or changes where necessary. The monitoring should include for any relevant condition assessments to ensure the special features of a Natura 2000 site and/or protected species are conserved in the best possible condition. Monitoring and evaluation are important in any enhancement and restoration project, as the information gained may lead to greater overall success and reduced costs in future restorations (Sears et al., 2006).
10. The OPW should introduce enhancement programmes for other habitats and species, additional to those for salmonids in river channels. These should also be applied on a catchment wide basis, rather than at specific points along a maintenance channel, which would take the conservation objective for a Natura 2000 site's qualifying interest and WFD objectives into consideration as a whole. Examples include Kingfisher embankments, grey wagtail nests, sandmartin embankments, artificial otter holts etc. It is important that these are designed and suitable areas chosen by suitable qualified ecologists.
11. As discussed in above the commissioning of scientific based pilot studies by the OPW is a great opportunity to improve work practices. A case study (pilot study) approach can be taken where results can be sensibly extrapolated to similar sites. However, in order to assist with pilot studies that can provide greater information and can be applied to a wide number of projects, it is recommended that the pilot studies are chosen based upon a screening process for suitability, applicability to other cases as well as financial for reasons.
12. The OPW can improve the evidence for the effectiveness of river restoration by investing in long-term monitoring (i.e. >5 years) at selected sites. These should encompass a large geographical range and use robust scientific approaches to evaluate projects that focus on process-based approaches. Monitoring should be undertaken before restoration and afterwards for a sufficient timescale to detect both rapid and longer term changes (Addy et al., 2016).
13. A review of arterial drainage schemes and their interaction with flood relief schemes should be undertaken. It should be discerned what responsibilities and activities are required to be carried out by the OPW as part of channel maintenance within a flood relief scheme so a specific final project design can be assessed through the Appropriate Assessment process.
14. A review of the adaptive capacity of the OPW's flood risk management strategies and measures in relation to climate change should be undertaken as maintaining arterial drainage schemes including those that form part of the Flood Relief Schemes, have the potential to impact on Natura 2000 sites due to their part in flood relief schemes. The impact

of maintaining arterial drainage schemes, channels and embankments on the adaptive capacity of ecosystems (including Natura 2000 sites, habitats and species) should also be considered, and fed into the long-term planning for arterial drainage schemes and their maintenance. This may include reconsidering activities in certain areas and examining how restoring ecosystems can play a big role in reducing the risk of the kind of floods.

15. There are opportunities for the OPW to incorporate objectives of the National Biodiversity Plan to minimise biodiversity loss and degradation of ecosystem services, and to optimise biodiversity gains, in flood risk management plans that will be implemented through CFRAMS. This objective should be implemented at project level at both the local and catchment level. For example, green revetment and other novel methods for stabilising bare banks (Koo & Hyojin, 2013). This however, requires training and should not be attempted by OPW staff without appropriate training and certifications.
16. There is a need to further investigate potential and inherent conflicts between flood risk management policy and legislation, and the OPW's statutory arterial drainage programme regarding wetland habitats. European best practise states that enhancing and protecting water retention capacity within catchments (including soil and wetlands) is important at all landscape scales (Williams et al., 2012) and the controlled flooding of certain stretches of riparian floodplains, or creation of storage areas that are periodically flooded by overflowing streams, should be incorporated into catchment and flood risk management.
17. New concepts of channel management should be explored by the OPW regarding channel performance and channel management at multiple scales, i.e. local, reach and catchment scales. Channels form part of a dynamic system and channel management issues can reflect different scale processes. Therefore, it is important to understand and try to work with natural processes and challenge the need for intervention. These elements of channel management could also link in with existing Flood Risk Management Plans and River Basin Management Plans in a sustainable approach to catchment and channel management, which would further reduce potential impacts on Natura 2000 sites.
18. OPW have carried out training programmes in the past for their staff in relation to environment and ecology. OPW should provide further training and updates to all staff on a regular basis and in particular in relation to any updates to SOPs and Environmental studies.
19. To ensure compliance with the Birds and Habitats Directive, proposed arterial drainage maintenance activities should undergo an Appropriate Assessment at project level, based on final project design or the specifics of the programme elements. The other technical areas such as hydraulic, hydrological and hydrogeological impacts resulting from the proposed works at project level should also be considered in the Appropriate Assessment.
20. For some of the proposed arterial drainage activities the development of a Construction Environmental Management Plan (CEMP) will be important to include mitigation measures as part of the AA. The inclusion of a CEMP will safeguard the integrity of the Natura 2000 network of sites by minimising the potential for habitat loss, disturbance of species and potential adverse impacts on water quality/quantity dependant sites. The CEMP will need to be site specific and relevant to the detailed design of the activity including associated activities such as access to river, runoff controls etc.

5 Summary and Conclusion

The proposed 6-year cycle of arterial drainage maintenance activities 2016-2021 pose potential negative impacts to Natura 2000 sites and their designated features of interest, as shown by the screening process and the Natura Impact Statement. In order to ensure that these impacts are not significant, it is recommended that an Appropriate Assessment be carried out for all drainage scheme channels, embankments and structures screened in. These Appropriate Assessments should be conducted at project level. Some of the schemes have been assessed, however NPWS have provided some recommendations and comments in some cases. The recommendations outlined in this NIS and those of the SEA will assist with the efficiency and effectiveness of Appropriate Assessments at project level, through better planning, working methods, increasing scientific knowledge and baseline data, and monitoring.

Having incorporated the suggested mitigation measures above; it is considered that the OPW Arterial Drainage Maintenance Activities (2016-2021) will not impact significantly on the Natura 2000 network of sites.

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Appendices

A OPW Environmental Management Protocols & Standard Operating Procedures



National Arterial Drainage Maintenance

Draft List of Activities 2016 – 2021

**Environment Section
Engineering Services
Office of Public Works**

March 2016

Contents:

- 1. Introduction**
- 2. List of Activities**
- 3. Environmental Management**
- 4. Mitigation & Monitoring**

1. Introduction

There is no statutory requirement under the Arterial Drainage Acts 1945 & 1995, for the production of a 'Plan' or 'Programme', for Arterial Drainage Maintenance. Following Strategic Environmental Assessment (SEA) screening consultations with the Environmental Protection Agency (EPA), it was deemed appropriate for an SEA to be carried out, as Arterial Drainage Maintenance is an ongoing activity in the State. This document has been produced to facilitate the SEA process.

Where the Commissioners of Public Works have completed a drainage scheme under the Arterial Drainage Acts, 1945 and 1995, there is a statutory requirement to maintain the drainage works forming part of the Scheme. These drainage works include watercourses, embankments and other structures. Watercourses are subject to siltation and erosion, among other processes, while embankments are subject to settlement and erosion. Ongoing maintenance activities are of a cyclic nature which are to maintain the channel at a certain outfall datum and conveyance capacity by means of repetitive works. An annual programme of maintenance is compiled to maintain the drainage works which are prioritised based on the rate of deterioration and the risk arising. In any one year, approximately one-fifth of watercourses are maintained.

1.1 Timescale

The 2016 – 2021 timescale has been adopted to facilitate the coordination with the River Basin Management Plans (RBMP) and Catchment Flood Risk Assessment and Management Studies (CFRAMS). The main EU Directives in the water management sector such as the Water Framework Directive (WFD) and the Floods Directive set a six year cycle approach from 2016-2021 and then 2022-2027.

1.2 Arterial Drainage Maintenance

1.2.1 Arterial Drainage Schemes

The Office of Public Works is the body through which Central Government exercises its statutory responsibilities in respect of river drainage and flood relief works. It derives its statutory authority from the Arterial Drainage Acts, 1945 and 1995 and the European Communities (Assessments and Management of Flood Risk) Regulations 2010.

Table 1 OPW Schemes carried out under Arterial Drainage Acts 1945 & 1995

Scheme	Duration of Works	Areas Benefiting (hectares)
<i>Major Schemes (River Catchments over 100,000 acres in extent)</i>		
Brosna	1948-1955	34883
Glyde & Dee	1950-1957	10643
Feale	1951-1959	10724
Corrib-Clare	1951-1959	10724
Maine	1954-1964	30310
Inny	1959-1963	4694
Deel	1962-1968	20234
Moy	1960-1971	4816
Corrib-Headford	1967-1973	24685
Boyne	1969-1986	48157
Maigue	1973-1986	12343
Corrib-Mask	1979-1986	9712
Boyle	1982-1992	10845
Blackwater (Monaghan)	1984-1992	2367
<i>Minor Schemes (River Catchments 25,000 – 1000,000 acres)</i>		
Nenagh	1955-1960	2630
Ballyteige/Kilmore	1959-1961	931
Broadmeadow& Ward	1961-1964	2995
Killimor/Cappagh	1962-1968	5099
Bonet	1982-1992	1295
<i>Other Small Schemes (River Catchments less than 25,000 acres)</i>		
Clareen	1959-1961	445
Ouvane	1962-1963	162
Matt	1964-1965	202
Duff	1963-1965	1457
Brickey	1965-1967	405
Abbey	1964-1967	364
Knockcroghery	1967-1968	202
Creegh	1968-1969	405
Burnfoot/Skeoge	1968-1970	162
Kilcoo	1969-1971	162
Owenavorrhagh	1968-1970	1052
Carrigahorig	1968-1971	1538
Groody	1970-1973	1214
Deel and Swillyburn	1957-1961	1416
Cloonburn	1967-1968	162
<i>Estuarine Embankment Schemes</i>		
Shannon (Limerick)	1962-1971	4897
Shannon (Clare)	1958-1960	728
Fergus	1959-1960	728
Owenogarney	1955-1959	850
Swilly	1961-1968	1295

<i>Flood Relief Schemes</i>	<i>Completion Date</i>
Belclare, Clare River maintained as part of the Corrib-Headford Drainage Scheme	1995
Gort Town, Co. Galway maintained as part of the Gort Flood Relief Scheme	1997
Sixmilebridge, Co. Clare maintained as part of the Owengarney Catchment Drainage Scheme	1997
Lacken (Ardraham), Co. Galway maintained as part of the Lacken Drainage Scheme.	1997
Nanny River, Duleek, Co. Meath maintained as part of the Nanny Scheme.	1998
Mulkear River, Newport, Co. Tipperary maintained as part of the Mulkear River Scheme	1998
Ballymakeogh, Co. Tipperary maintained as part of the Scheme	1998
Mulkear River, Cappaghmore, Co. Limerick maintained as part of the Scheme	2000
Bridge End, Co. Donegal , improvement to the Skeoge Scheme and is maintained as part of the Scheme.	2000
Bandon River, Dunmanway, Co. Cork , this is maintained as part of the Scheme.	2001
Shinkeen Stream, Hazelhatch, Co. Kildare , this is maintained as part of the Scheme.	2001
Maam Valley, Co. Galway ; this was an improvement to the Scheme, and is maintained as part of the Scheme.	2001
Suir River, Carrick-on-Suir, Co. Tipperary ; this is maintained as part of the Scheme.	2003
Nore River, Kilkenny ; This is maintained as part of the Scheme	2006
Ennis, Co. Clare , maintained by the OPW but the maintenance of the pumps is through SLA with the County Council.	2013
Mornington, Co. Meath , maintained as part of the Mornington Scheme	2012
Tullamore, Co. Offaly , this is maintained as part of the Scheme.	2013
Clonmel, Co. Tipperary maintained by the OPW, however maintenance pumps is through SLA and the County Councils.	2014
Fermoy, Co. Cork maintained by the OPW, however maintenance pumps is through SLA and the County Councils.	2015
Mallow, Co. Cork maintained by the OPW, however maintenance pumps is through SLA and the County Councils.	2016
Belclare, Clare River maintained as part of the Corrib-Headford Drainage Scheme	1995
Gort Town, Co. Galway maintained as part of the Gort Flood Relief Scheme	1997
Sixmilebridge, Co. Clare maintained as part of the Owengarney Catchment Drainage Scheme	1997
Lacken (Ardraham), Co. Galway maintained as part of the Lacken Drainage Scheme.	1997
Nanny River, Duleek, Co. Meath maintained as part of the Nanny Scheme.	1998
Mulkear River, Newport, Co. Tipperary maintained as part of the Mulkear River Scheme	1998

1.2.2 OPW's Roles and Responsibilities in Arterial Drainage Maintenance

Under Section 37 of the Arterial Drainage Act 1945, the OPW is statutorily obliged to maintain all rivers, embankments and urban flood defences on which it has executed works since the 1945 Act (**Table 1**) in “proper repair and effective condition”.

Maintenance referred to under the Arterial Drainage Act 1945 includes:

- The maintenance of river channels in a condition that ensures they are free-flowing, thus reducing flood risk and providing adequate outfall for land drainage.
- The maintenance of river and coastal embankments, in a condition that protects benefiting lands to the extent defined in the Scheme, from risk of flooding.
- The maintenance, repair and/or replacement of all structures forming part of a Scheme, including accommodation bridges, weirs, sluice barrages, sluices, pumping stations and tidal flap gates.

The Act uses the terms “*proper repair and effective condition*”. The performance criteria relate to the design standard of the original Scheme works, its condition and performance of the various watercourses, embankments etc.

Failure to comply with these obligations would be contrary to the Drainage Acts and could lead to a “writ of mandamus” or an award of compensation arising from claims for damage to the benefiting lands. All of the completed Arterial Drainage and Estuarine Embankment Schemes are now maintained under the statutory obligation.

1.2.3 Extent of Operations

OPW Head Office is based in Trim, Co Meath. The maintenance function is divided into three regions for the purpose of programming and executing the work, **Table 2**. Each region has a main regional office with at least one sub office. The annual maintenance budget is circa €15 Million. The OPW maintain their own transport and excavator fleet and other specialised equipment such as weed cutting boats. The operations are carried out by a trained direct labour work force numbering circa 300. OPW direct labour staff uses a fleet of approximately seventy hydraulic excavators nationwide to execute the maintenance programme.

Table 2 OPW Drainage Maintenance Office Locations

Region	Main Regional Office	Sub-Office(s)
East	Newtown, Trim, Co. Meath	Ardee, Monaghan, Mullingar & Wexford
South West	Templemungret, Co. Limerick	Listowel & Portumna
West	Headford, Co. Galway	Ballina & Lifford

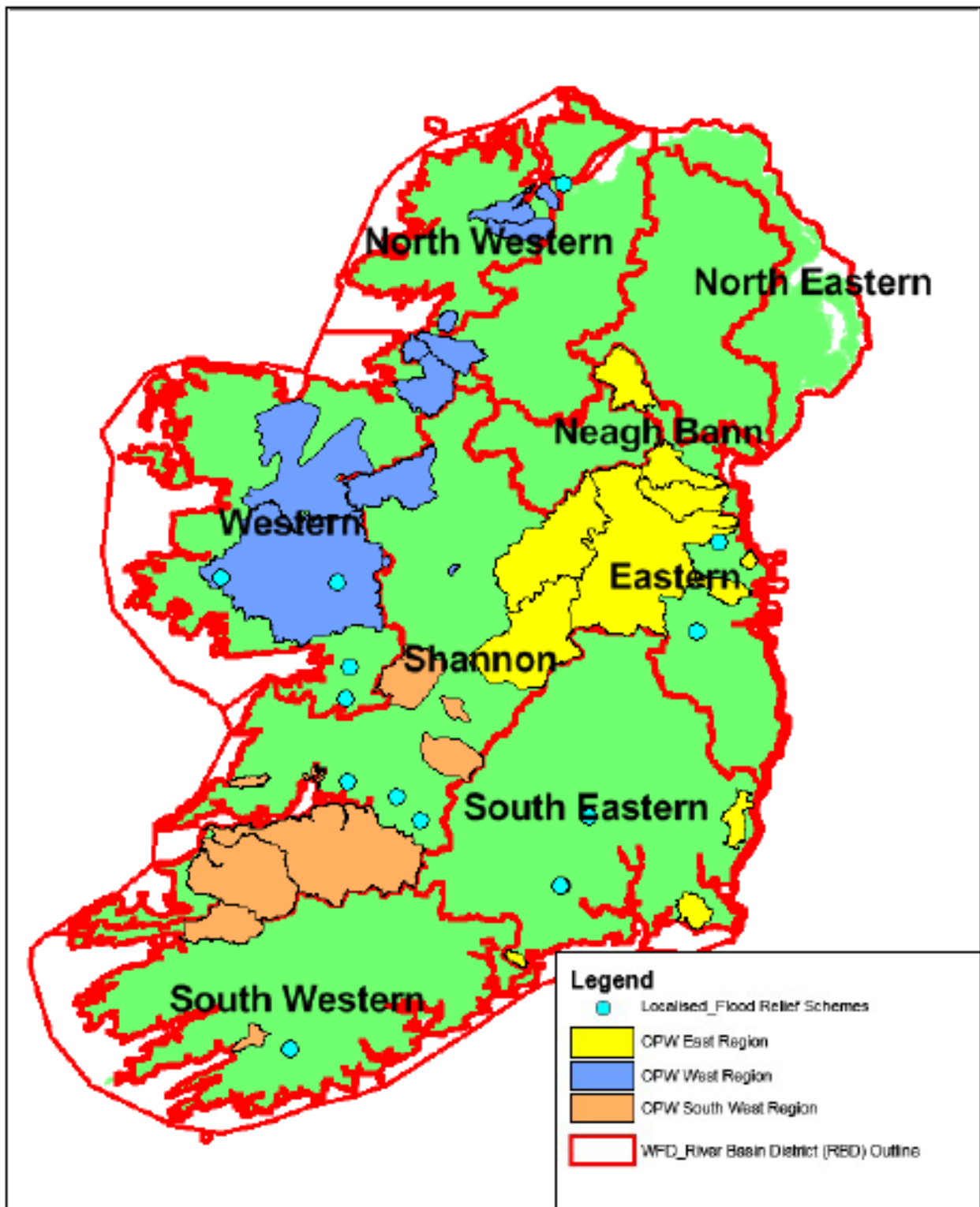


Figure 3.1 Arterial Drainage Catchments and RBDs



Figure 3.2 OPW East Region Schemes

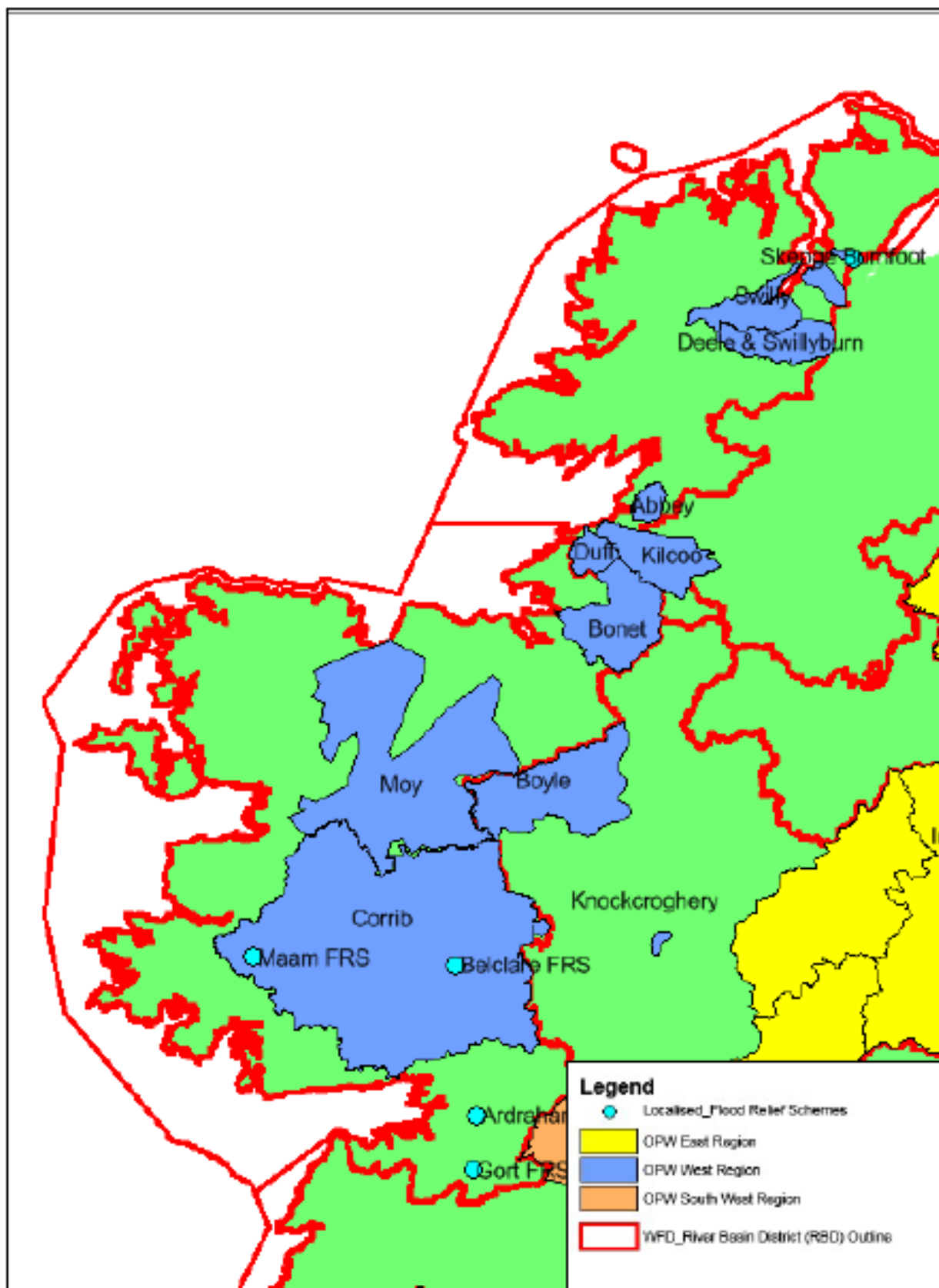


Figure 3.3 OPW West Region Schemes

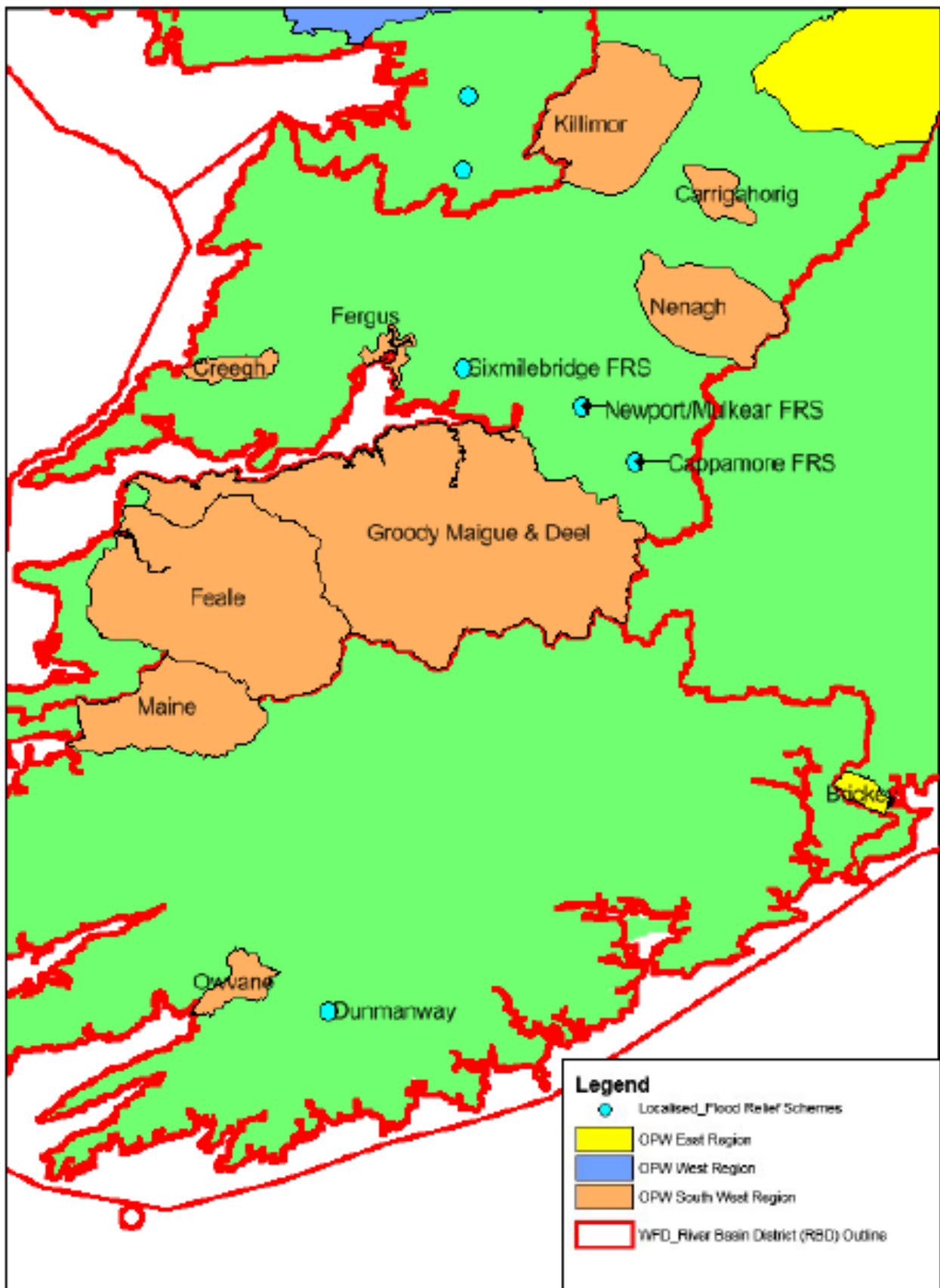


Figure 3.4 OPW South West Region Schemes

2.0 List of Activities

The National Arterial Drainage Maintenance 2016-2021 activities includes:

1. Channel Maintenance activities
2. Embankment Maintenance activities
3. Structural Maintenance activities
4. Flood Relief Scheme Maintenance activities

Statutory Arterial Drainage Maintenance entails the maintenance of completed Arterial Drainage Schemes and completed Flood Relief Schemes. The OPW are responsible for the maintenance of 11,500km of channel, 730km of embankments, some 18,500 bridges and 750 ancillary structures such as sluice gates, pumping stations and tidal barrages.

The majority of Arterial Drainage Maintenance works is on channel maintenance with the average channel requiring maintenance every four to six years. While this varies, with some channels requiring maintenance annually and others only requiring maintenance every twenty years, circa 2000km of channels are maintained annually and nearly all of the 11,500km of channels will have been maintained at least once over the Programme cycle of five years. Of the 750km of embankments, the frequency of maintenance tends to be more variable than that for channels with embankments scheduled for maintenance works as the need arises. There is an ongoing programme of Flood Relief Schemes carried by the OPW and statutory Arterial Drainage Maintenance includes the maintenance of these schemes. In respect of the various bridges and structures, a relatively small number are maintained annually i.e. circa 170 bridges and 30 other structures which are restricted to the most critical structures. Note that a portion of the 18,500 bridges are road bridges where the Local Authorities are responsible for the structural integrity, hence OPW maintenance operations typically exclude bridge deck or arch repair works on road bridges.

2.1 Channel Maintenance Activities 2016 – 2021

Channel maintenance operations normally involves removing the build up of foreign or natural material that impedes the free flow of water. Predominately this consists of the removal of water-entrained silt and associated vegetation from the bed of the channel by suitably rigged hydraulic excavators. Restrictions in channels due to bank slippage or damage would be re-graded to the original profile. Channel breaches due to bank erosion would be resolved by re-profiling the bank in-situ or in some cases by importing protection material such as rock armour or log poles. In addition, other larger vegetation such as trees, which impinge on channel capacity are either removed in whole or impingement is reduced by selective removal of lower branches. The material removed in the maintenance operations is normally spread along the bank, or on top of existing spoil heaps where present. In most cases, no alterations to the bank are required and in some cases the channel is not disturbed at all if no build up of material is present.

Some channels are steep and fast flowing, which are subject to flash floods, bank erosion and rapid movement of bed gravel. However, 60 – 70% of Scheme channels are of gentle longitudinal gradient and subject to relatively rapid deposition of silt, especially those that are subject to prolific growth of in-stream vegetation. The steeper sections of channel normally require relatively little maintenance works. The

majority of maintenance works are on smaller lower-lying channels, with 90% of works in channels with a base width of less than three metres. The average channel requires maintenance every four to six years. Channels with prolific weed growth may require maintenance annually, particularly where downstream bridges are at risk of being blocked due to a flow of decaying vegetation in autumn. Conversely, some channels may only require maintenance every twenty years due to the self-cleaning characteristics of the channel.

A number of channels have an annual prolific growth of aquatic plants, but are too wide or the bank conditions are too unstable to allow maintenance by way of excavators. Weed cutting boats are engaged in these cases, or where a particular channel requires to be cleared of vegetation but it is not deemed necessary to remove silt or other heavy material. In all, approximately 90km of channel are cleaned annually by four weed cutting boats, operating on a seasonal basis, with the majority of the works concentrated in the West of Ireland.

Historical databases have been built up in all regions. From these are extracted a base line list of channels which are due for cleaning. Critical sections of these channels are inspected and a work programme developed. This takes account of requests from the general public and potential flooding risk to roads, properties, urban areas and sewage works.

In developing the works programme, special consideration is given to potential impacts on fisheries, Natura 2000 Sites and the environment. This includes assessment of all works for their potential to impact on Natura 2000 sites by an external ecological consultants, specific timing of certain works, and consultation with both Inland Fisheries Ireland and National Parks and Wildlife Service

In general, scheme channel maintenance work is carried out by trained OPW drivers, using a hydraulic excavator. The material removed is normally spread along the bank or on top of existing spoil heaps where present.

2.2 Embankment Maintenance Activities 2016 – 2021

Most Embankment Schemes are tidal in nature hence they tend to be located at estuaries. The foremost inland embankments are the Annagh Embankments, on the Inny Arterial Drainage Scheme. During the period between 1987-1993 the financial resources for drainage maintenance were reduced resulting in a reduction in staff numbers and in the capability of OPW to carry out necessary work. By 1994 the deteriorating condition of the embankments, which at some critical locations had been eroded to less than half their original volume, gave cause for great concern, especially in Kerry, Wexford and Donegal. A programme of embankment strengthening was put in place to redress this.

Currently, programming of maintenance work consists of regular inspections of sections of embankments, which are known from experience to be at risk, together with additional inspections after a storm at sea, or a high tidal/flood event in the case of tidal embankments. Embankments are scheduled for works when it is deemed that the structure is in need of repair to maintain an effective condition. Repair works normally take the form of topping up clay embankments to design height and structural strengthening by importing rock/soil material or utilising in-situ material.

In addition, the programme extends to the refurbishment of the deteriorated embankments in Kerry, Wexford and Donegal. The Shannon Embankments are also undergoing refurbishment works, due to their importance to flood defence for Limerick and Shannon Town. The refurbishment of the embankments is carried out by contract or by direct labour.

2.3 Structural Maintenance Activities 2016 – 2021

During the course of the original Arterial Drainage Scheme excavations following the 1945 Act, circa 18,500 accommodation bridges were modified or replaced as required. These bridges provide riparian farmers with farm vehicular/foot access. The type of bridge provided depended on the width, depth and required flow capacity, and ranged from concrete piped culverts to larger concrete or masonry spanned bridges.

In general, as channel maintenance work proceeds, the bridges are inspected by supervisory industrial staff, and if required repairs/replacements are programmed. On many occasions, it is not necessary to totally replace the structure, and repairs such as under-pinning foundations or replacement of wing walls, parapets or deck are carried out to extend the bridge life.

Currently all Scheme structure maintenance work is carried out by the direct labour gangs. Approximately 170 bridges are repaired/replaced each year. Ancillary structures such as sluice gates, tidal barrages and pumping stations are repaired or replaced as necessary to maintain their respective operating function.

2.1.4 Part 1.4 - Flood Relief Scheme Maintenance Activities 2016 – 2021

Flood Relief Schemes completed since the Arterial Drainage (Amendment) Act, 1995 also have a statutory maintenance requirement. The requirement for maintenance is identified at regional level on an annual basis, and included in the Annual Arterial Drainage Maintenance Programme. Maintenance cycles vary depending on the characteristics of the Flood Relief Scheme. Original scheme works that included durable structural works such as new embankments, retaining walls or hard bank reinforcement typically require little or no maintenance while some flood relief scheme channels require periodic silt removal or riparian vegetation management, to maintain the designed channel capacity.

2.4 Programme Exclusions

The National Arterial Drainage Maintenance Activities 2016-2021 list of activities does not include the following:

- Newly constructed Arterial Drainage Schemes.
- Catchment Flood Risk Assessment & Management Studies (CFRAMS).
- New Flood Relief Schemes – carried out under the Arterial Drainage Acts 1945-1995, which entail aspects such as public exhibition and Ministerial approval. Modern Flood Relief Schemes typically involve relatively large-scale engineering construction, generally within the confines of an urban area and designed to specific criteria such as 1 in 100 year flood protection.

- Drainage Districts – channel maintenance works on the various Drainage Districts by Local Authorities or Drainage Boards.

3.0 Environmental Management

All maintenance operations are carried out in accordance with OPW's Environmental Management Protocols and Standard Operating Procedures.

3.1 OPW Environmental Management Protocols

Communications - Statutory Stakeholders

- By the end of each year, each Arterial Drainage Maintenance Region to forward a draft version of its Annual Drainage Maintenance Programme for the upcoming year to OPW's Environment Section, and to the Inland Fisheries Ireland (IFI) EREP Project Manager who will review it for appropriate sites and study locations for the Environmental River Enhancement Programme (EREP) project.
- By end of each year, each Arterial Drainage Maintenance Region to forward the relevant sections of the final version of its Annual Drainage Maintenance Programme for the upcoming year with a copy of appropriate scheme maps, to the National Parks & Wildlife Services (NPWS) Regional Managers and the IFI Directors.
- When compiling the programme the type of works proposed should be indicated for each channel under the headings A-F:
 - A – Silt & Vegetation Management
 - B – Aquatic Vegetation Cutting
 - C – Bank Protection
 - D – Bush Cutting/Branch Trimming
 - E – Tree Cutting
 - F – Bridge/ Structure Repairs
- Ideally, approximate timing (season/month) and approximate duration of works should be included for each channel.
- Works that fall within Special Areas of Conservation (SAC), Special Protection Areas (SPA) or Natural Heritage Areas (NHA) are to be highlighted on the programme.
- As a follow up, the Arterial Drainage Maintenance Regions offer the opportunity for a meeting with the stakeholders to discuss the Annual Drainage Maintenance Programme and where a meeting is requested, preferable for this to take place as early as possible in the year.

Interim Stakeholders Meetings

- In addition to the start of the year stakeholder meeting to overview the Annual Works Programme, Regional Offices will offer and facilitate a schedule of more frequent and catchment focused meetings.
- The need and the frequency of these meetings will be determined on a regional basis in partnership with the relevant stakeholders.
- Typically a frequency of every 2-3 months to discuss the following 2-3 months work on the catchment, identifying any further environmental sensitivities, appropriate mitigating measures, follow up joint site visits where deemed beneficial and flagging any opportunities for added benefit in proposed River Enhancement works.
- Typical attendance includes a range of OPW Management Staff, i.e. Engineer, Technician and/or Foreman, NPWS Rangers and/or DCO and IFI Officers.

- OPW Engineer will compile minutes of the meeting to record attendance and a brief account of main decisions and follow up actions.
- Any channel specific information resulting from these meetings, such as timing requests should be entered into the Records Database in accordance with the National Recording Process.
- Consultations with statutory stakeholders such as NPWS and IFI are of critical importance to continuously improving environmental performance. However, in the interest of maximising the efficiency of stakeholders input, Management Staff are as far as practical, to plan their consultative requirements and address a range of aspects in any one discussion forum. Interim Stakeholder Meetings or similar forums offer good opportunities to maximise consultation efficiencies.

Correspondence

- All Environment related correspondence/complaints are recorded on the Engineering Services Correspondence Database as per normal protocol. Complaints received are forwarded to the Environment Section should assistance be required. All queries/complaints are responded to within 21 days.

Walkover Surveys

- As a component to the EREP Project, on a number of channels, EREP project team members will request for Walkover Surveys as an opportunity to discuss in detail on site the environmental enhancement options for a particular channel with a range of relevant stakeholders.
- Typical attendance will be an IFI EREP representative, a range of OPW Management Staff and relevant Operational Crew if deemed beneficial, local IFI Officer and/or NPWS Ranger or DCO.
- OPW Management Staff to liaise with EREP team and coordinate the site visit with local IFI and NPWS to facilitate their participation if these stakeholders wish to attend.
- Environmental river enhancement plans are then prepared by the IFI EREP team and issued to the relevant OPW Engineer for inclusion in the annual works programme

Appropriate Assessments

- A national framework has been set up where Arterial Drainage Maintenance activities will undergo Appropriate Assessment (AA) to include all required activities for a 5 year period
- Environment Section procures for the annual `Environmental Consultancy Services` contract, prepares the 5 year programme for each scheme and issues completed AA Screening Statements/Conclusion Statements to the respective OPW engineers as completed.
- The Ecological Consultant will consult with OPW management to define the precise extents of proposed works in each Natura 2000 Site during the 5 year period.

- In addition, the Ecological Consultant will be carrying out walkover surveys for pre and post maintenance works for a representative number of the sites and OPW Management will be required to facilitate the same.
- OPW Management Staff will issue the relevant completed Assessments directly to the NPWS District Conservation Officer. In addition, Environment Section will issue all of the Assessments to the Development Applications Unit, Department of Arts, Heritage and the Gaeltacht, Newtown Road, Wexford.
- Preferably the Appropriate Assessments are forwarded to the DCO as soon as it is completed, but in any case with a minimum of three weeks notice before commencement of the works.
- Management Staff to implement all prescribed mitigating measures and ensure that Operational Staff are made aware of all relevant site specific mitigating measures.

Environmental River Enhancement Programme (EREP)

- After reviewing the draft Annual Works Programme, IFI EREP team contact the relevant OPW Regional Office and request follow up meetings as required to discuss aspects of the programme in relation to the EREP.
- River enhancement sites require hydromorphological surveys to ensure they are technically feasible as envisaged. This is to be coordinated by the IFI EREP team with local IFI and OPW personnel as required.
- Sites shortlisted by the IFI EREP project team for capital enhancement works are emanating from a screening process of technical feasibility in terms of gradient and water quality. Also, sites are selected on other requirements such as the Water Framework Directive Programme of Measures under the requirements for morphology.
- IFI EREP team in consultation with the local IFI and OPW staff, will prioritise sites on a basis of best return for investment. IFI EREP team will liaise with the Regional Offices to assist in identifying channels deemed suitable for capital enhancement which should be integrated with the following years work programme. In some cases, a situation may arise where the site selected is not overlapping with the annual Drainage Maintenance Programme but where feasible and subject to any third party agreement, OPW will accommodate these works.
- Similarly for enhanced maintenance works, IFI EREP team in consultation with the local IFI and OPW, will select sites again that are technically feasible and offer best return for investment. These sites will normally be from channels on the annual Drainage Maintenance Programme.
- IFI EREP project team will coordinate all the scientific monitoring works, provide the enhancement design details and guidance to OPW Management Staff and maintain a level of site supervision proportional to the complexity of the works and the experience of the OPW Staff involved.
- Consultations with local IFI through the interim stakeholder meetings are encouraged to identify sites suitable for enhancement works and in some cases the local IFI may also be in a position to produce an enhancement design. All enhancement designs and works are to be coordinated through the IFI EREP team to facilitate formal recording into the national EREP project and allow for biodiversity and/or hydromorphology monitoring if required. Local

IFI may coordinate with IFI EREP team or alternatively OPW Regional Staff coordinate directly with the EREP team.

- A small portion of channels have more infrequent maintenance cycles and these cases can offer particularly good opportunities for enhanced maintenance type works. Channels programmed where maintenance works have not being carried out for in excess of 10 years, to be flagged to IFI EREP team for possible walkover surveys and guidance on appropriate Environmental Drainage Maintenance (EDM) procedures.
- Management Staff to ensure that as far as practical, all Operational crews have an opportunity to get experience on these projects.
- Each Regional Engineer is to make provision in the Annual Works Programme for Plant & Labour resources in addition to provisions in the Annual Budget for materials subject to expenditure constraints. Typical resources are as follows:

Capital Enhancement

Region	Target (Km)	Capital Costs	Machine Weeks	Man Weeks
East Region	20	€200,000	30	60
South West Region	14	€140,000	21	42
West Region	16	€160,000	24	48
	50	€500,000	75	150

- Progress targets for EREP to be shown on monthly production reports.
- OPW are the primary contact point for liaison with landowners including the organising of access and egress for machinery and materials. Brochures on EREP are available in all Regional Offices. Additional copies can be obtained through OPW Environment Section.
- Management Staff are encouraged to maximise the use of all available on-site materials such as stone from historical spoil heaps as opposed to importing materials at a higher cost.
- In addition, Management Staff are encouraged to maximise synergies with other funding sources such as Fisheries Development grants attained by local Angling Clubs, which could be combined with OPW plant and labour to supply materials.
- In all cases, Inland Fisheries Ireland is the statutory authority to give design guidance to OPW. Angling Clubs or other sectoral funding sources to liaise with the Fisheries authorities in respect of all design and environmental monitoring requirements.
- As-Built plans are to be completed by the IFI EREP team for all enhancement works. This will entail a site visit by IFI and relevant OPW Staff where requested. These will be retained by IFI as well as any relevant design information.
- IFI EREP team will forward a copy of the as-built plans to Environment Section who will upload the same to Alfresco for access to the information by all Staff.
- At the end of the year, IFI EREP team will forward Environment Section a GIS layer of that year's works for uploading to OPW's GIS records.
-

National Recording Process

- Weekly Record Cards records information on Lamprey, Crayfish, Kingfisher, Mussels, Otter and other site specific environmental information as arises.
- Environmental information on Cards will be recorded onto the Records Database by each Drainage office. The latest Records Database has been revised to integrate environmental records.
- On an interim basis, a copy of all Cards with environmental information to be copied and forwarded to Environment Section by each Drainage Office. This is to allow Environment Section to review the detail of information being recorded, feedback to the Operational crews through the Management Staff and attain a national consistency in the style of information being recorded.
- All relevant information to be uploaded to GIS by Environment Section.
- All other relevant environmental information sourced by Management Staff whether from direct observations or through stakeholder consultations, should be entered into the Records Database.
- Relevant environmental information sourced through the EREP project and related research will be forwarded by IFI EREP team to Environment Section directly for centralised GIS uploading.
- On a bi-annual basis, Environment Section will compile an update of Weekly Records Cards species records and make available to all Staff via Socialtext to assist in tracking progress.
- On an ongoing basis, Environment Section will make available the various OPW compiled species records to other authorities to assist in contributing to any appropriate national conservation knowledge.
- As described above, each drainage office will upload onto the Records Database all environmental information from the Weekly Record Cards and all other broader environmental information attained by Management Staff. Within a few years, it's envisaged that multiple regional Staff will be able to use the new Records Database, and then environmental information from all sources will be uploaded directly by a whole host of Staff. Typically this will include any mitigating agreements for particular channels agreed with stakeholders or any other individuals observation such as protected species presence noted during a separate site visit.

Salmonids

- As far as practicable, the maintenance works are to be scheduled to accommodate salmonid (Salmon & Trout) spawning areas, as is in place across all regions for many years. This is a widespread measure on many catchments and is most applicable to medium gradient channels with gravel substrate.
- Prior to works commencing, consult with local IFI. Ideally, consultations to be conducted through Interim Stakeholder Meetings or alternatively, direct contact in respect of the specific site.
- Maintenance operations on salmonid spawning beds typically carried out between July and September but timing subject to adjustment due to local knowledge of IFI.
- Raking of spawning gravels to improve spawning capacity also typically carried out between July and September.

- River enhancement works to enhance both the fisheries and the broader ecology of the drainage channel are covered under the EREP project.
- In the future, as the extent of completed enhancement works increases, there is a risk of damage to structures due to future maintenance. All channels scheduled for maintenance to be checked against GIS records for presence of previous enhancement works. Where a presence is indicated, carry out a site visit as appropriate and in consultation with IFI, devise on-site procedures to protect or enhance existing instream structures.

Lamprey (Brook, River & Sea) & Crayfish

- All channels scheduled for maintenance to be checked against GIS records for presence of Lamprey or Crayfish.
- In accordance with the OPW Protocols and SOPs, Operational Staff will closely observe the spoil three times daily and report to the Foreman any Lamprey or Crayfish located.
- Mitigating procedures to apply when GIS records indicate species presence, or Operational Staff locate Lamprey or Crayfish during operations, or where particularly suitable habitat is identified by an environmental stakeholder.
- If significant populations are encountered, notify IFI EREP team and facilitate scientific studies if site deemed suitable by IFI.
- If significant populations are encountered, notify NPWS Ranger and local IFI Officer and conduct site visit as necessary.
- Combination of Mitigating Measures to be selected as applicable to the site while balancing the Flood Risk Management requirements and a sustainable approach to the conservation of Lamprey and/or Crayfish.
- Identify extent of channel applicable and the mitigating measures to apply.
- Inform Operational Staff of mitigating requirements.

Suite of relevant Mitigating Measures as follows:

On site measures

- Skip sections to retain intact habitat either in one long reach or multiple short reaches.
- Maintenance in an upstream direction to avoid secondary disturbance of a species moving downstream. Balance with the advantage of maintenance in a downstream direction where instream vegetation minimises siltation.
- Confine maintenance to 2/3 of channel width leaving marginal vegetation and silt intact.
- Maximise use of weed cutting bucket particularly where aquatic vegetation removal is the primary objective. This is effective for Lamprey juveniles as they are in the silt. For Crayfish, cutting of “Flaggers” type vegetation is effective but cutting of “water celery” mat type vegetation is less effective as it can result in Crayfish being removed within the weed mass.

Forward planning measures

- Annual maintenance of the channel in shorter segments sequentially completing the same over a number of years. Balance with maintaining reasonably operational efficiency in terms of machinery moving, transport, access and egress.
- Longer time periods between maintenance cycles e.g. move from 4-6 years to 7 to 8 years. Balance with overall river ecology as longer maintenance cycles will lead to more heavy-scale works.
- Timing of maintenance to accommodate Lamprey spawning. Stakeholder consultations between OPW and local IFI for salmonid mitigating purposes, to include consideration of Lamprey spawning. This is to be applied to channels where Lamprey spawning habitat is known as informed by IFI or other stakeholder. For River & Brook Lamprey, no works on relevant spawning channel from end March to start of June subject to adjustment due to local knowledge of IFI. For Sea Lamprey, as they spawn during the summer months, restrictions from late April to early July are required. To be applied to channels where Sea Lamprey spawning is known as informed by IFI or other stakeholder and timing subject to adjustment due to local knowledge of IFI. Note that Sea Lamprey are much less widespread so envisaged that the scale of this mitigation will be very limited.
- Loosening spawning bed gravels. Stakeholder consultations between OPW and IFI for salmonid gravel loosening purposes, now to include consideration of Lamprey spawning as above.
- Enhance channel profile such as skewed cross section and promote deposition of silt along margins. Integrate with IFI discussions on planning the EREP to avail of enhancement opportunities particularly for channels where Lamprey or Crayfish presence is recorded.
- Modification of OPW structures which impede upstream fish migration. Identification of weirs as barriers to be as informed by IFI or other stakeholder. Where modification designs required, liaison with IFI EREP team to integrate the improvement works into the EREP project. Identification of a bridge apron step attained through ongoing site inspections by OPW Management Staff or other stakeholder. In consultation with IFI, steps at bridges to be modified by a

rock armour type ramp or similar. Envisaged that these measures will be of a limited scale on drained channels.

GIS Records:

- Where Lamprey or Crayfish are discovered, Operational Staff will have recorded the same on the Weekly Record Cards. Cards with species location information will be uploaded to the Records Database as stated in the National Recording Process.
- All new Lamprey spawning location information attained through stakeholder consultation to be recorded on the Records Database in accordance with the National Recording Process.
- All database records of species location will be uploaded to GIS by Environment Section.
- IFI EREP team conducting ongoing research on Lamprey & Crayfish as a component of the EREP works. Scientific data calculating species density for some sites will be developed and to be supplied by IFI to OPW and uploaded to GIS by Environment Section.

Otter

- Research to date indicates that Otters are widespread across all sizes of drainage channels nationally, hence it is prudent to assume that Otter use any particular site.
- In accordance with the Otter SOP, Operational Staff will walkover the works area one week in advance in conjunction with the Health & Safety assessment noting dense cover with access directly to the water that is to be avoided where feasible.
- In addition, any recognisable signs of Otter presence observed such as Spraints, Footprints or suspected Holts, will be recorded on the Weekly Record Cards. These signs were identified in Otter Awareness Training carried out across all regions in 2008.
- While holts are usually well concealed, where Operational Staff observe a suspected holt such as a burrow opening, in consultation with Management Staff, subject to flood risk management functions, no channel or bankside vegetation to be conducted within 30m of a known or potential Otter holt/resting site. If breeding is suspected at a holt site this buffer zone will be increased to 150m.

Bridge mammal crossing enhancement

- As a component of ongoing consultations with NPWS and other stakeholders, evidence may arise from time to time as to a particular spot for Otter road kill. Typically this can arise where the Otter always traverses the roadway as opposed to going through the bridge. While this scenario is not known to be a widespread issue in Ireland, the highest risk locations are on the National Primary Roads which have the heaviest traffic volumes.
- There are 170 National Primary Road bridges on OPW channels as listed in the table referenced below and Management Staff are to have particular regard to these locations if evidence arises on a possible road kill “hot spot”.

- Enhancement works will typically take the form of a bolt-on wildlife ledge or similar. Design and configuration is to be carried out in consultation with NPWS and relevant Local Authority.
- On an annual basis, Environment Section will review the national website www.biology.ie which records Otter road kill reports from the public. Any road kill location which overlaps with an OPW channel will be flagged by Environment Section to the relevant Management Staff.
- Current understanding is that Otter road kill is not a significant issue in Ireland. It's envisaged that while the justification for bridge mammal crossing works may arise for some scenarios, these measures will be of a limited scale on drained channels.

Freshwater Pearl Mussel

- GIS records from NPWS show the locations of the 91 known FWPM populations in Ireland.
- The following OPW channels have been identified as containing FWPM:

Channel	Scheme	Location	Most Recent Record
CH9	Corrib Headford	Oughterard	2009
C1/21/3	Moy	Approx 500yds from outfall to into L. Cullin	2004
C1 Sect M&N	Moy	Ballygallagart	2004
C1/21/14	Moy	Crossmolina	2008
C1	Dunmanway FRS	d/s of the Long Bridge	2003
C1	Owvane	Approx 1400 yds from outfall	2002
C1	Feale	d/s Listowel near Scartleigh cemetery	2006
**Owenaher	Moy	u/s of C1/54	1996
**Brown Flesk Ri	Maine	Trib of C1 Maine near Farranfore	1987
** Galey River	Feale	Approx 1400yds u/s of C1/18 near Ahavoher Br.	1950
**River Liffey	Ryewater	(Lucan) Approx 3.5km d/s C1 Ryewater outfall	1894

*** Although not on OPW channels - these channels may or may not contain populations of FWPM.*

Works in the vicinity which could impact on a possible population need to be considered in close consultation with local NPWS knowledge.

- While highly unlikely to have instream works in a FWPM habitat, if a new population located by Operational Staff during operations, works to cease.

- Notify NPWS and in consultation with NPWS, area to be skipped or non in-stream works carried out as agreed for the specific site.
- For operations in the vicinity of known populations, mitigating procedures to apply:
- Consult with NPWS and local IFI and conduct site visit as necessary.
 - Typically only selective non in-stream works adjoining the population.
 - Works such as removal of a fallen tree is to be completed by lifting clear of the channel to minimise any channel bed disturbance due to the branches being dragged.
 - Assess need for silt management procedures for works upstream of the population and implement in consultation with NPWS.

Swan & Duck Mussels

- Swan and Duck Mussels are not strictly a protected species, however they are of conservation interest.
- Both species are similar in appearance and habitat requirements and distinguishing between them is not necessary unless local environmental stakeholders can identify the exact species.
- As the Mussel SOP, if Operational Staff locate the same, Management Staff will be notified.
- Where significant populations are encountered notify NPWS Ranger and local IFI Officer, and where they are interested in visiting the site, facilitate a site visit as necessary.
- Identify extent of channel applicable and the mitigating measures to apply.
- Typical Mitigating Measures include:
- Operational Staff to observe spoil and return any Mussels to the channel whom are expected to recolonise the channel bed.
- Maximise use of weed cutting bucket particularly where aquatic vegetation removal is the primary objective.
- Skip sections to retain intact habitat either in one long reach or multiple short reaches.
- Confine maintenance to 2/3 of channel width leaving marginal vegetation and silt intact.
- Record species presence on the Weekly Record Cards which will be recorded on the Records Database.

Kingfisher

- Avoid disturbing nesting sites in banks.
- Visual sightings of Kingfisher by Operational Staff to be recorded on the Weekly Record Cards.
- Sightings by Management Staff to be recorded on the Weekly Record Cards where works in progress or on other occasions, record by separate map or channel reference format.
- All sightings to be recorded on the Records Database in accordance with the National Recording Process.

- All database records of species location will be uploaded to GIS by Environment Section.
- On an annual basis, Environment Section will issue the records to Birdwatch Ireland whom will add to the national Kingfisher database.

Birds

- Removal of any abnormally dense layer of vegetation is to be executed between September and February (inclusive) to minimise impacts on nesting birds unless there are other overriding requirements such as Health & Safety.
- For SPAs containing important over-wintering bird populations, in consultation with the NPWS, regard to be given to timing or phasing of the works to minimise potential disturbance.

Bats

- While the removal of large mature trees is not typically a requirement of maintenance works, where the case arises, in consultation with NPWS, regard to be given to the likelihood of bat roosting habitat.
- Typical mitigating measure would be to leave tree in fallen position for 24hrs to allow any bats vacate.
- Masonry bridges offer niches and crevices suitable for bat roosts and where masonry bridges are scheduled for maintenance works, regard to be given to the likelihood of bat roosting habitat. Typical maintenance works at low level such as wing wall repair or underpinning foundations have limited potential to impact on bat roosts. Where the case arises that repair works are to be above the high water level such as the upper arch, in consultation with NPWS, assess the potential for the works impacting on bat roosts.
- Typical mitigating measure would be to contract a bat specialist to survey for bat presence before works commence, to avoid entombment of any bats.

Wetlands - Bogs, Fens & Turloughs

- All channels scheduled for maintenance which overlap SAC designations to be checked against the list of channels that impinge on Raised Bog, Fen habitat or Turloughs and have regard to any NPWS agreements noted *.
- OPW Management Staff to consult with NPWS for expert opinion as to any evidence of ongoing ecological decline of the Bog, Fen or Turlough and judgement on, if the drainage datum set by the Drainage Scheme and its maintenance is an ongoing contributing factor by affecting the hydrological regime of the same.
- Where a likely impact is identified, conduct site visit as necessary and in consultation with NPWS, mitigating measures to be selected such as:
- Skipping the channel in question while taking cognisance of the flood risk management requirements.
- Maximise use of weed cutting bucket particularly where aquatic vegetation removal is the primary objective.
- Inspection by OPW line management to assess the possibility of over digging the channel below the original design datum. Presence of an existing water level control such as a bridge floor to be established and alternative reference datum to be installed if deemed warranted.

** Environment Section currently developing a list of channels which overlap with Raised Bog, Fen habitat and Turloughs within SACs. Channels that are subject to a previous NPWS agreement /understanding of the extent of maintenance will be recorded.*

Invasive Species – Plants

- Multiple invasive plant species are widespread nationally as described in the SOP and prudent to assume that one or more of these plants can be present on any works site.
- At present the OPW does not have any direct responsibility for the management of Invasive species. However to ensure OPW operations are not a vector for these invasives, measures are required to reduce the risk of spread.
- Ensure machine washing equipment transported to site for all appropriate machinery movements as described in the Invasive Species SOP.
- Ongoing EDM site audits by Environment Section will include confirmation that machine washing was executed in accordance with the SOP for the last applicable machine transfer.
- In some cases, OPW will assist other authorities in the control of invasive species. In these projects, the works are typically carried out in partnership between a number of authorities such as IFI, NPWS and relevant Local Authority. As scenarios arise where OPW are requested to assist in an invasive species control project, Management Staff are encouraged to support the multi-authority partnership model which will maximise resource efficiencies for all parties while still achieving a broader environmental good.

Invasive Species – Zebra Mussel

- Zebra Mussels are present in the River Shannon, Grand Canal and are in many lakes such as L Derg, L Ree, L Garra, L Key, L Derragh, Derravaragh, L Sheelin and L Corrib. This species is spreading and it is prudent to assume that works in any large sluggish river or near a lake has potential to contain Zebra Mussel.
- For any proposed works in the vicinity of potential Zebra Mussel waters, flag for Operational Staff and ensure particular attention to cleaning procedures for all equipment prior to removal from site.
- Any new location of Zebra Mussel uncovered during operations, notify NPWS and IFI for their information.
- Record on Weekly Record Sheet which will be uploaded on the Records Database in accordance with the National Recording Process.
- On an annual basis, Environment Section will collate the records nationally and issue to any relevant authorities to assist in tracking the species spread.

Tree Management

- A small portion of channels have more infrequent maintenance cycles typically where self cleaning gradients are present. These sites can entail abnormally dense tree cover which may be required to be managed for conveyance or fisheries purposes. Removal of any abnormally dense layer of vegetation is to

be executed between September and February (inclusive) to minimise impacts on nesting birds unless there are other overriding requirements.

- IFI requests to reduce “tunnelling” on drainage channels to be accommodated where feasible. OPW Management Staff to facilitate a site visit with the IFI Officer as required and devise a selective approach to the tree removal so as to retain a dappling of shade along the channel length.
- Excess woody vegetation to be collected and utilised by the following in order of preference:
 - Reused by adjoining landowner for domestic firewood.
 - Subject to landowners agreement, stockpile excess to form natural cover and niche habitat, preferably with some connection of cover to the channel e.g. along a hedge leading to the water.
 - Shred and spread along the adjoining top of bank allowing the material to degrade rapidly and recolonisation of the underlying vegetation.

Environmental Drainage Maintenance (EDM) Guidelines

- A portion of operational crews will be audited annually for implementation of the EDM Guidelines and other standard environmental procedures as adopted.
- Auditing will be carried out separately by both IFI and OPW Environment Section on a rotational basis to ensure all operational crews are audited at least once every three years.
- Audit results will be recorded on a standard format with the following feedback:
 - All audit results will be forwarded to the relevant Engineer for that Drainage Scheme within two working weeks.
 - In the event of an audit showing elements of unreasonable non-compliance with procedures, the relevant Engineer will be notified within one working day.
 - Audit results will be forwarded to OPW Systems Co-ordinator for inclusion in monthly regional benchmarking reports.
 - IFI EREP team will compile an overall summary of their findings in their end of year report under the EREP project.
- Design for Enhanced Maintenance works under EREP will include a design element for full scale implementation of the EDM Guidelines such as Boulder Replacement and Excavating Pools.
- Management Staff to ensure that as far as practical, all Operational crews have an opportunity to get experience on these projects.

OPW Standard Operating Procedures (SOPs)

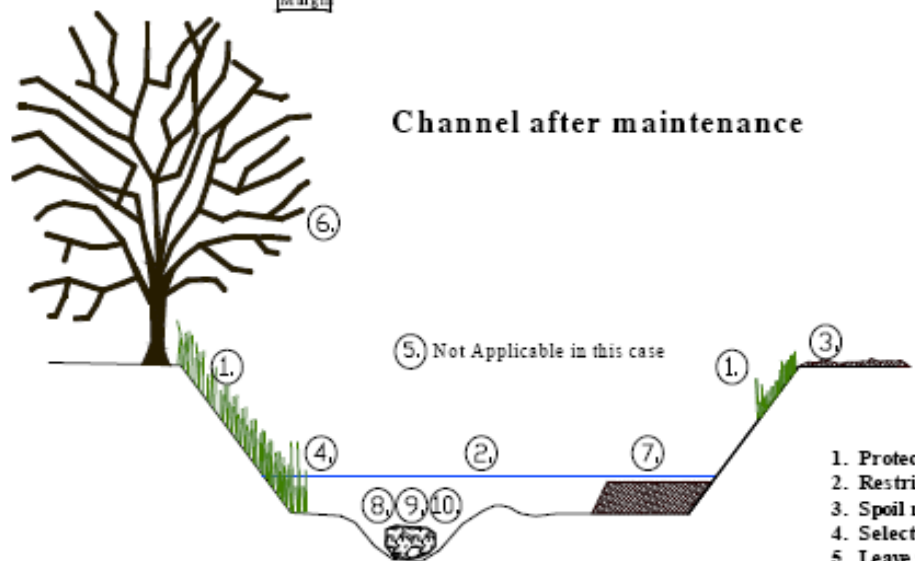
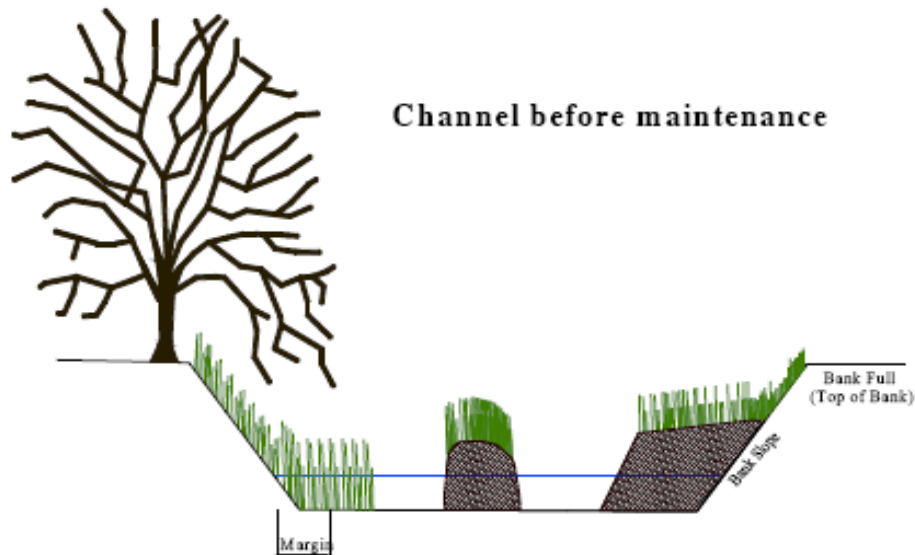
A total of 7 No. Standard Operating Procedures are applied during operational works. These SOPs set out actions designed to eliminate, or substantially reduce impacts to identified species and their associated habitats. These include:

- Environmental Drainage Maintenance Guidance Notes (10 Steps to Environmentally Friendly Maintenance)
- Lamprey SOP
- Crayfish SOP
- Otter SOP
- Mussel SOP
- Invasive Species SOP
- Zebra Mussel SOP

Environmental Drainage Maintenance Guidance Notes



10 Steps to Environmentally Friendly Maintenance



1. Protect bank slopes
2. Restrict maintenance to channel
3. Spoil management
4. Selective vegetation removal
5. Leave section untouched
6. Management of trees
7. Manage berm to form two stage channel
8. Replace stones and boulders
9. Loosen gravel beds
10. Re-profile channel bed

Environmental Strategies for Channel Maintenance



1. Protect bank slopes

- 1.1 Do not disturb the non-working bank slope
- 1.2 Minimise any effect on working bank
- 1.3 Leave margin of vegetation at foot of each bank slope



2. Restrict maintenance to channel

- 2.1 Remove only necessary silt – no new diggings
- 2.2 Remove instream material only
- 2.3 Retain marginal vegetation
- 2.4 Check spoil regularly. *See Lamprey & Crayfish SOPs*

3. Spoil Management

- 3.1 Maximise spoil placement on bank full line or spoil heaps **and**
- 3.2 Minimise spoil placement on bank slopes
- 3.3 Spread spoil as thinly as possible
- 3.4 Allow water to drain out of bucket over the water – lets small fish, lamprey and crayfish escape



4. Selective Vegetation Removal

- 4.1 Retain a band of vegetation on both sides at water's edge
- 4.2 Selectively manage instream vegetation
- 4.3 Maximise use of weed-cutting bucket
- 4.4 Avoid maintenance in coarse fish channels from 1st April to 1st July



- 4.5 Retain 1/3 to 1/2 of instream floating type vegetation, such as *Ranunculus* (water crowfoot) – see photo to right



5. Leave sections untouched

- 5.1 If channel capacity is not affected, leave section alone



Environmental Strategies for Channel Maintenance



6. Management of Trees

- 6.1 Remove trees that are blocking the flow
- 6.2 Tree-cutting window 1st September to 28th February



- 6.3 Remove overhanging branches to known flood level

- 6.4 Use saw secateurs for removal, not excavator bucket

- 6.5 Manage Trees to reduce very heavy shading
- 6.6 Manage briars and scrub.
See Otter SOP



7. Manage berms to form two-stage channels

- 7.1 Retain berm where channel capacity is not affected
- 7.2 Remove top of berms to low flow levels
- 7.2 Remove vegetation and soil from gravel berms
- 7.3 Replace sod to the berm where feasible
- 7.4 Only narrow berms if 'excessively' wide for the channel (i.e. greater than a third of the channel width)



8. Replace stone and boulders

- 8.1 Reinststate boulders and gravels as removed by maintenance operations
- 8.2 Reinststate suitably sized boulders into channel from spoil heaps where feasible
- 8.3 Boulders should be placed at or below low flow level and spaced out

9. Work in gravel bed channels

- 9.1 Loosen or toss bed gravels to wash out fines
- 9.2 Only considered between 1st July and 30th September
- 9.3 No work in gravel bed / spawning channels in fisheries 'closed season'
Note: This varies locally check with local IFI



Environmental Strategies for Channel Maintenance



10.1 Excavate bed to form deeper pool areas and shallow riffles



10.2 Overdeepen the channel along one side and place spoil on opposite side –particularly on curves and bends

10.3 Use existing boulders to form simple low-level structures



10.4 Record where such works are carried out

BROOK, RIVER & SEA LAMPREY STANDARD OPERATING PROCEDURE - ARTERIAL DRAINAGE MAINTENANCE

Actions during Maintenance Operations

- Machine gangs to closely observe the spoil three times daily for Lamprey (and Crayfish).
- Where Lamprey encountered:
 - Contact area Foreman immediately.
 - Foreman to contact Engineering Staff in line with the Environmental Management Protocols.
 - Record the location and abundance of Lamprey on the time card.

Measures as directed by Foreman to minimise impact may include:

- Skip a defined stretch of channel.
- Confine maintenance to 2/3 of channel width leaving marginal vegetation and silt intact.
- Maximise use of weed cutting bucket particularly where aquatic vegetation removal is the primary objective.



Lamprey in the spoil

RIVER, BROOK & SEA LAMPREY IDENTIFICATION CARD



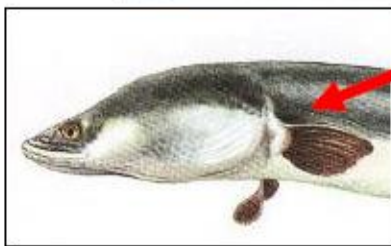
Gill Pores



Lamprey and young eels can look very similar. These key identifying features can be used to distinguish the two species

Lamprey:

- Gill Pores (Holes)
- No Fins
- No Jaw
- Average length 8 to 15cm (3 to 6 inches)



No Gill pores

Eels: No Gill Pores

Paired Fins

Jawed Mouth

Average length 65cm (26 inches)

Juvenile Lamprey:

- Juvenile Lampreys live in the sediment.
- It is in this juvenile phase that they can be removed from the sediment during maintenance.



Adult Lamprey:

- Largest is the Sea Lamprey species.
- Also are River and Brook Lamprey
- Length from 30 to 60cm (12 to 24 inches).



WHITE-CLAWED CRAYFISH

STANDARD OPERATING PROCEDURE - ARTERIAL DRAINAGE MAINTENANCE

Actions during Maintenance Operations

- Machine gangs to closely observe the spoil three times daily for Crayfish (and Lamprey).
- Where Crayfish encountered:
 - Contact area Foreman immediately.
 - Foreman to contact Engineering Staff in line with the Environmental Management Protocols.
 - Record the location and abundance of Crayfish on the time card.

Measures as directed by Foreman to minimise impact may include:

- Skip a defined stretch of channel.
- Confine maintenance to 2/3 of channel width leaving marginal vegetation and silt intact.
- Maximise use of weed cutting bucket particularly where aquatic vegetation removal is the primary objective.



Crayfish in the spoil

WHITE-CLAWED CRAYFISH

Identification

- Resemble small lobsters.
- Colour varies from light to dark green-brown, with large front claws.
- Adults typically 7cm - 10cm (3" - 4") long.
- Juveniles can be as small as 2cm (1") long.
- Prefer channels with
 - dense weed cover (flaggers / watercelery) or
 - with a mixture of rocks / gravels that provide crevices for cover.



OTTER

STANDARD OPERATING PROCEDURE - ARTERIAL DRAINAGE MAINTENANCE

Week before Maintenance Operations begin:

- Operational staff will walkover works area one week in advance in conjunction with the PRA noting areas of dense cover with access directly to the water. (As identified during Otter Awareness Training)
- These areas of suitable cover should be avoided where feasible during maintenance.
- Suspected presence of an Otter holt to be reported immediately to area Foreman, who will contact Engineering Staff in line with the Environmental Management Protocols.
- Signs of Otter presence observed such as Spraints, Footprints or suspected Holts, to be recorded on the Weekly Record Cards.

Measures to minimise disturbance may include:

- Retain suitable cover where possible.
- Areas of dense scrub to be avoided by large plant.
- Skip stretch of channel in proximity of suspected holt.



Otters

- Widespread presence on OPW channels.
- Shy animals and not normally seen.
- Adults 1 metre long and weigh 10kg.
- Streamlined profile.

OTTER

Holts

- Usually well concealed.
- Typically burrows, or spaces under banks, tree roots or dense cover.



Spraints

- Found on rocks, paths, channel junctions.
- Dark, oily, sweet smelling.

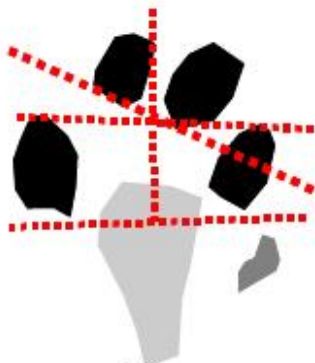


Suitable areas of cover

Dense bankside vegetation, particularly where there is direct covered access to the water.
Any isolated clumps of dense vegetation giving cover along an open length of channel.

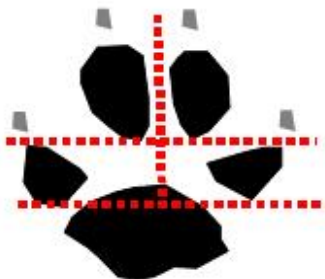


Foot-prints



Otter

(Non-symmetrical toes)



Dog

(Symmetrical toes)



Fox



Badger



Mink

MUSSELS

STANDARD OPERATING PROCEDURE - ARTERIAL DRAINAGE MAINTENANCE

FRESH WATER PEARL MUSSELS

Before Maintenance Operations begin:

- Maintenance must not commence where a known population of Fresh Water Pearl Mussel exists (as listed in the Environmental Management Protocols).
- In the unlikely event of new population of Fresh Water Pearl Mussel being encountered during maintenance,
 - **All works must cease immediately.**
 - Contact area Foreman.
 - Record the location of Mussels on the time card.

Measures to minimise disturbance may include:

- Placing of straw bales to prevent movement of silt.
- Any exceptional / emergency works to be carried out in close consultation with the NPWS.
- For exceptional / emergency works e.g. fallen tree obstruction – these to be lifted clear of the channel to prevent disturbing the channel bed.

MUSSELS



Fresh Water Pearl Mussels (*Margaritifera margaritifera*)

- Shells very thick & heavy – shaped like a kidney.
- Shell colour is dark-brown – black, to blue & black.
- Adults range in length from approx. 6 cm – 12 cm (2.5 – 5 inches) and can live for over 100 years.
- Suitable rivers are reasonably fast flowing, with very clean, good quality water, gravel bed, preferably with large cobbles.



Not to be confused with Duck & Swan Mussel

- Egg-shaped shells 12 -16cm (5-6 inches) long.
- Thin shiny shells, usually brownish yellow with traces of green.
- Found in slow moving water.
- If encountered, contact area Foreman and return Mussels to channel.
- Record location of Mussels on time card



INVASIVE SPECIES STANDARD OPERATING PROCEDURE – ARTERIAL DRAINAGE MAINTENANCE

Measures to reduce the risk of spread of invasive species

All excavators, weed cutting boats, tractors, dumpers & other machinery employed on maintenance must be thoroughly cleaned down using a power washer unit prior to being;

- (a) transported by Low- Loader**
- (b) moving to another catchment within the Region**
- (c) moving to another Region.**

Notify your supervisor immediately if you see any of the invasive species listed.

*Full details of all species are available in the CFB's
Field guide to the Identification of Aquatic Invasive Species*



Giant Hogweed

Found on the banks of many rivers throughout Ireland.

Can grow to a height of 4 metres.

Seeds are carried by water and spread very quickly.

!!!Avoid contact with the sap of this plant as it can cause extensive lesions or blistering of the skin.



Japanese Knotweed

Grows up to 2-3m in height along roadsides and river corridors throughout the country.

Even a tiny piece of this plant can produce a new plant.

Leaves are heart-shaped with a pale stripe down the centre.

In Summer cream flowers arise from the tips of the red-flecked stems.



Himalayan Balsam

Grows in dense strands up to 3m high, and is found widespread across Ireland along banks of rivers.

Seed pods explode scattering seeds.

Dies back in Autumn exposing bare banksides to erosion.

White or pink flowers, smooth hollow stem, oval shaped pointed leaves with jagged edges.



Curly waterweed – *Lagarosiphon major*

Found in lakes and slow flowing waterways up to 6m deep.

Spread by fragmentation from one watercourse to another on boat hulls, trailers, outboard motors or angling equipment.

Significant weed stands located in Lough Corrib.



Zebra Mussels

Distinctive stripy shell, very small (1-3cm).

Attach in clusters to hard surfaces – boats, pipes, buoys.

Refer to the [Zebra Mussel Standard Operating Procedure](#).

All photographs courtesy of Central Fisheries Board

ZEBRA MUSSEL

STANDARD OPERATING PROCEDURE - ARTERIAL DRAINAGE MAINTENANCE



Actions for Maintenance Operations

1) Zebra Mussels detected on site

- Where Zebra Mussels are found, remark on the extent of Mussels on the Weekly Report Card and notify the Foreman/Technician.
- Technicians/Engineers to notify Environment Section of location and grid reference.
- Environment Section to update the National Database.

2) Maintenance close to R. Shannon or infested lakes

- Where a machine is working close to the R. Shannon or an infested lake, ensure that prior to the machine transferring to a new site, buckets and tracks are thoroughly cleaned of any material such as silt or vegetation.
- Ganger / Driver to visually inspect the bucket, tracks and any equipment that was in the water to ensure no Mussels are present.

3) Maintenance close to outlets/inlets of any lakes

- Where a machine is working close to any lake, ensure that prior to machine transferring to a new site, buckets are clean of any material such as silt or vegetation.
- Ganger / Driver to visually inspect the bucket and other equipment that was in the water to ensure no Mussels are present.

4) Boats and other equipment

- Boats or other water based equipment that is to be transferred between river catchments should be thoroughly cleaned on the outside, drained of any bilge water and inspected for the presence of Mussels.
- If it's suspected that the equipment was in contact with Zebra Mussel waters, steam clean the hull and trailer and leave the boat or equipment out of water for four weeks prior to moving.

OPW Role

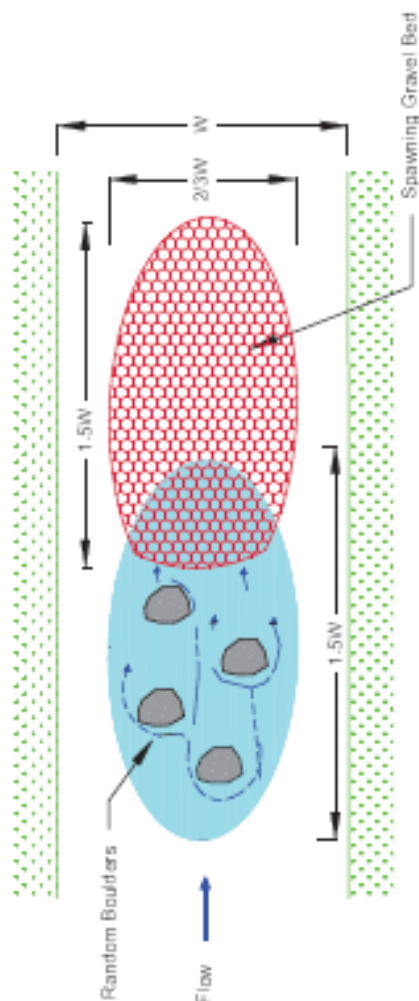
Although it is a relatively low risk, OPW could spread Zebra Mussels if aquatic vegetation or excavated material containing Mussels is inadvertently transported to another non-infested channel. Adult Mussels can survive for up to four weeks out of water hence its critical not to transport the same. Larvae are tiny and barely visible but will not survive on a machine bucket if there is no silt, stones or vegetation to shelter it.



Environmental Threat

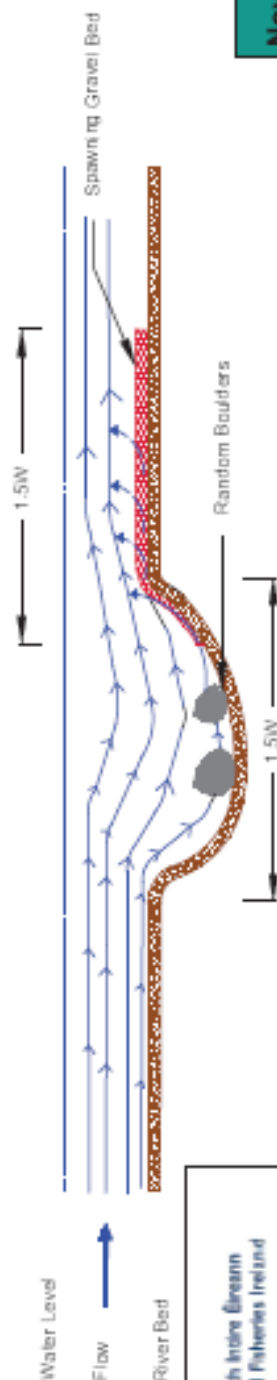
Zebra Mussels are thumbnail-sized black & orange striped shellfish. They grow into dense clusters and attach to any underwater hard surface. They are an invasive species that damage the natural ecology of the infested waters. They expand into catchments through been transported by man's activities e.g. transferring fishing boats. Once in a particular lake or river, if conditions are favourable, they will multiply and spread with the currents. It is envisaged that they will keep expanding their territory unless man makes a concerted effort to prevent transport of the Mussels into non-infested waters.

Detail 1: Centre Channel Pool with Gravel Bed

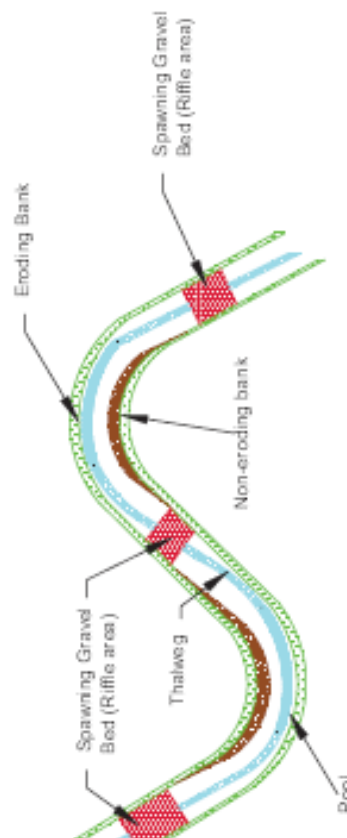
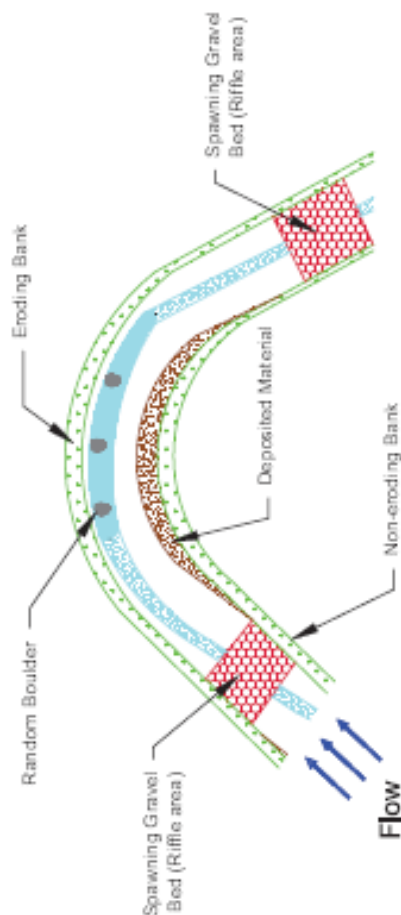


NOTES:

1. Pool length = 1.5 times channel base-width
2. Pool should be constructed in the centre of the channel with a width occupying approximately $\frac{2}{3}$ of channel base-width and should be egg-shaped
3. Gradually slope down to the deepest point in the centre and taper back up towards the tail and both sides
4. The depth of the pool varies according to the size of the channel. Typically the pool depth below low water level, ranges from 0.9m for smaller channels up to 1.5m for larger channels
5. Start to place gravel at tail of pool (downstream end)
6. Gravel bed and pool should be equal in length (1.5 times channel base-width)
7. Gravel bed should be 350-400mm deep
8. Place a number of boulders in pool in a triangular or diamond pattern depending on the size of channel
9. Ensure boulders are large enough to remain in place during flood flows
10. Pool spacings along the channel should be 5 to 7 times the channel base width or follow F1 design

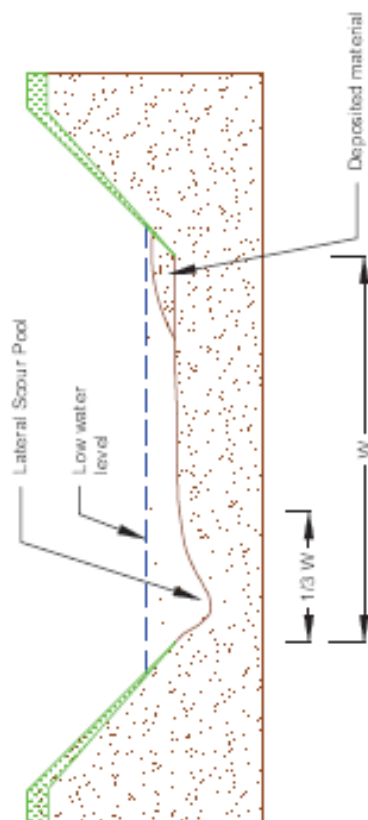


Detail 2: Lateral Scour Pool with Gravel Bed



NOTES:

1. Pool width approximately $\frac{1}{3}$ of channel base-width placed on eroding side of channel
2. Pool should be banana shaped
3. Gradually slope down to deepest point in the centre and taper back up towards the tail and both sides
4. The depth of the pool varies according to the size of the channel. Typically, the pool depth below low water level, ranges from 0.9m for smaller channels up to 1.5m for larger channels
5. Gravel bed placed on existing riffle area - See IRI Design
6. Place a number of boulders in the pool in a triangular or diamond pattern
7. Excavate thalweg to a depth of approximately 0.5m below summer water level
8. Deposit excavated material on inside of bend to form a berm if no berm present



Detail 3: Grave | Bed Detail

NOTES:

- Gravel bed should be 350mm-450mm deep
- Gravel bed should occupy the full channel cross section
- Gravel should be washed rounded stones of varying particle sizes as detailed in Table 1 for trout and Table 2 for salmon
- Sample existing spawning gravels to confirm similarity with gravels as supplied by quarry supplier

Table 1: Trout

Type	Grade	% Composition
Cobble	64-190 mm	0
Very coarse gravel	32-64 mm	30
Coarse gravel	16-32 mm	35
Medium gravel	8-16 mm	35

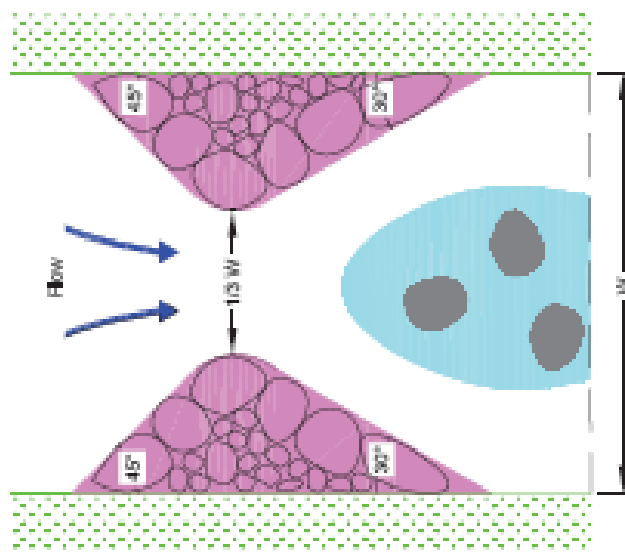
Trout: Percentage composition of gravel required

Table 2: Salmon

Type	Grade	% Composition
Cobble	64-190 mm	10
Very coarse gravel	32-64 mm	35
Coarse gravel	16-32 mm	25
Medium gravel	8-16 mm	30

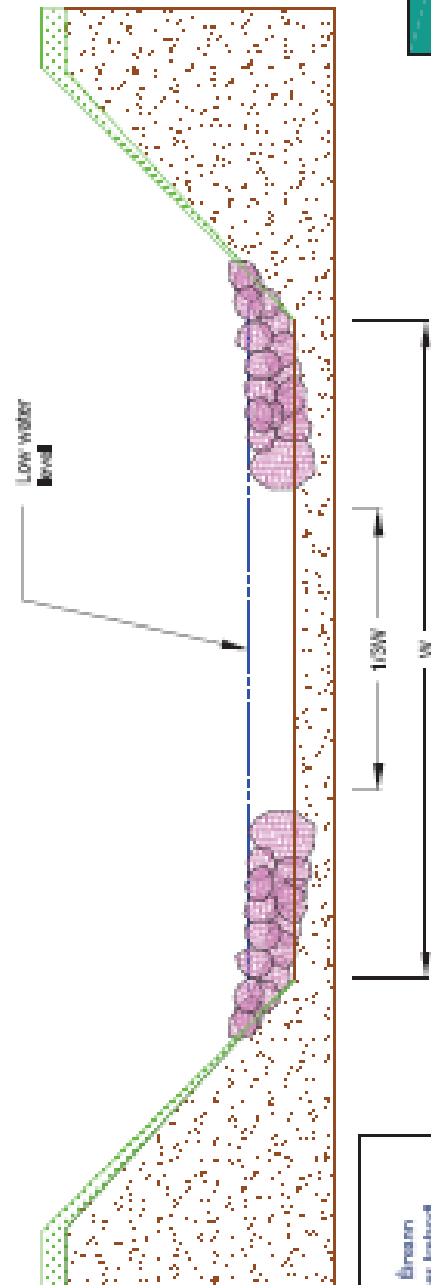
Salmon: Percentage composition of gravel required

Detail 4: Paired Stone Deflectors

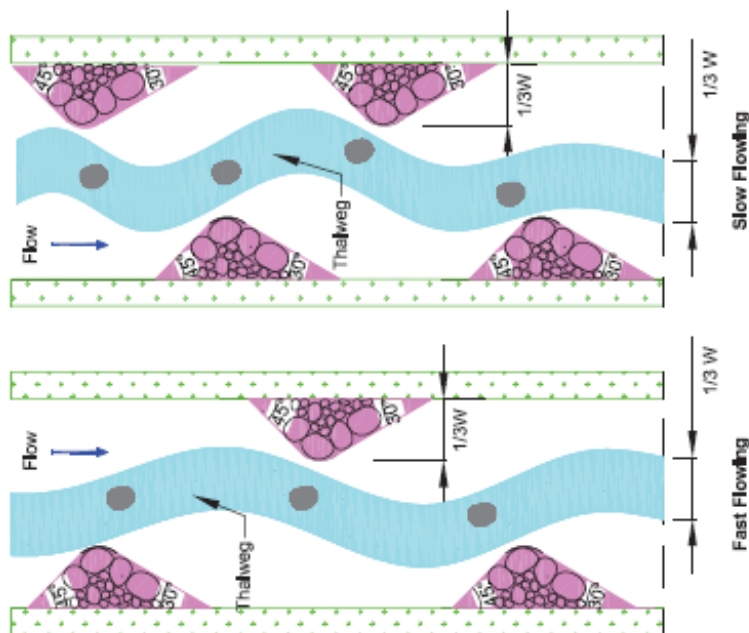


NOTES:

1. 45° angle on upstream slope
2. 30° angle on downstream slope
3. Deflector should slope down from bank
4. Stones at outer tip of deflector should be partially buried and the top of the stones should not be higher than low water level
5. These boulders should be the largest available to ensure they can withstand the energy in the channel
6. Use material excavated from pool to backfill deflectors. If no excess material is on site, backfill deflectors with broken stone
7. A space of $\frac{1}{3}$ channel base-width should be left between the paired deflectors

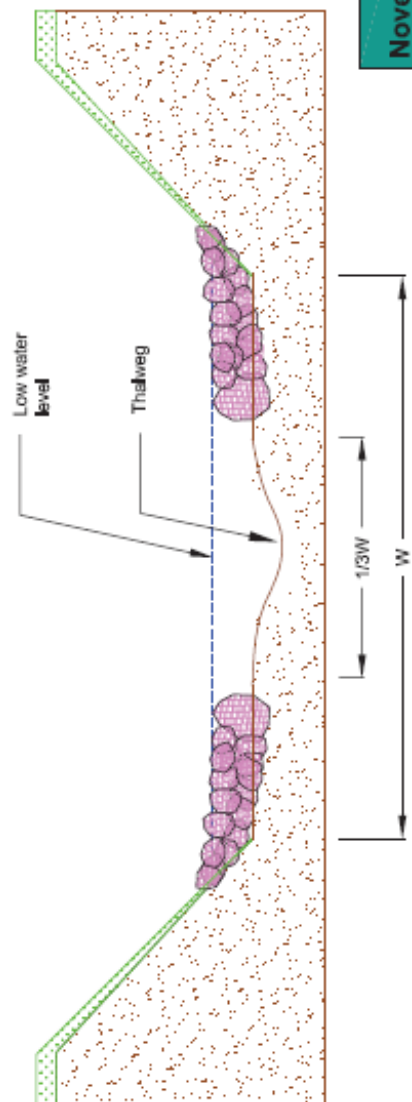


Detail 5: Alternating Stone Deflectors

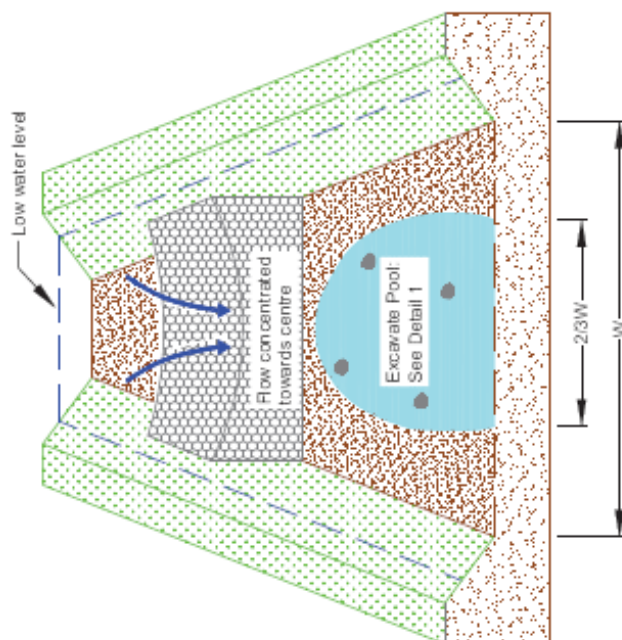


NOTES:

1. 45° degree angle on upstream slope.
2. 30° degree angle on downstream slope.
3. Deflector should slope down from bank.
4. Stones at outer tip of deflector should be partially buried and the top of the stones should not be higher than low water level.
5. Deflector width should be $\frac{1}{3}$ of channel base width.
6. In fast flowing rivers deflectors should not overlap.
7. In slow flowing wide channels deflectors should overlap.
8. Cover deflectors with scraw/vegetation where available.

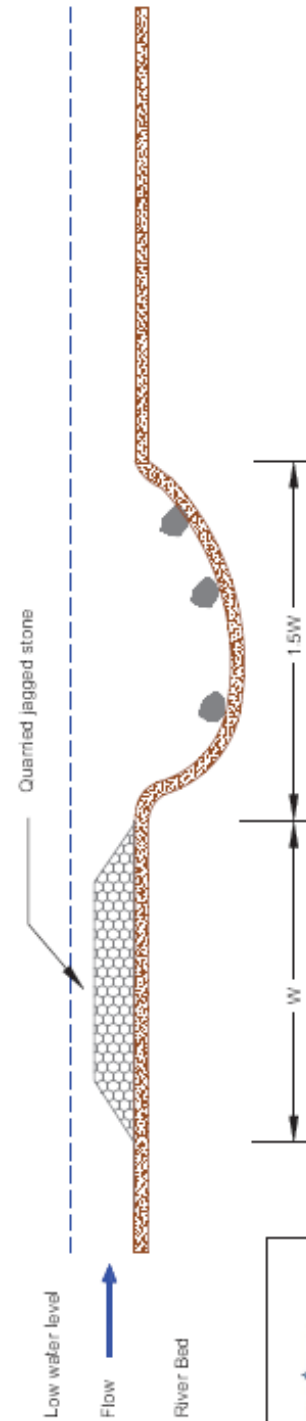


Detail 6: Rubble Mat

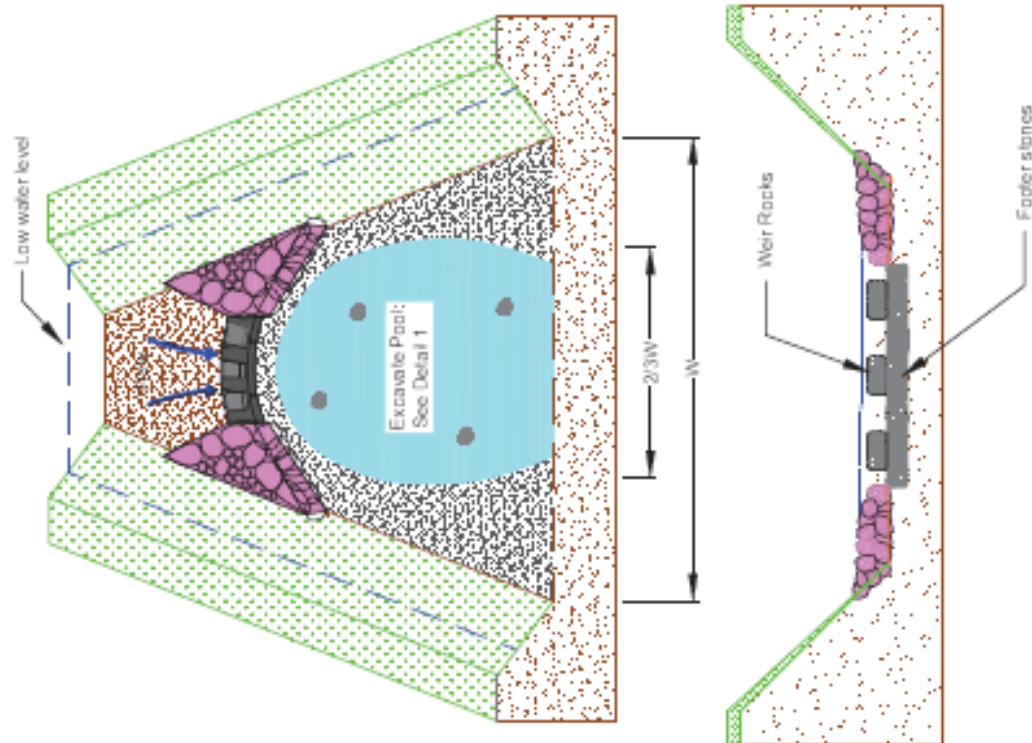


NOTES:

1. Rubble mat consists of broken quarried stone (150 - 250mm)
2. Rubble mat length equal to channel basewidth
3. Stone placed below low water level from bank to bank
4. Gulley should be made through the rubble mat concentrating flow towards centre of channel
5. Excavate a pool downstream of the mat (See Detail 1: Centre Channel Pool)
6. Height of rubble mat will vary according to water depth - Follow IFI Design

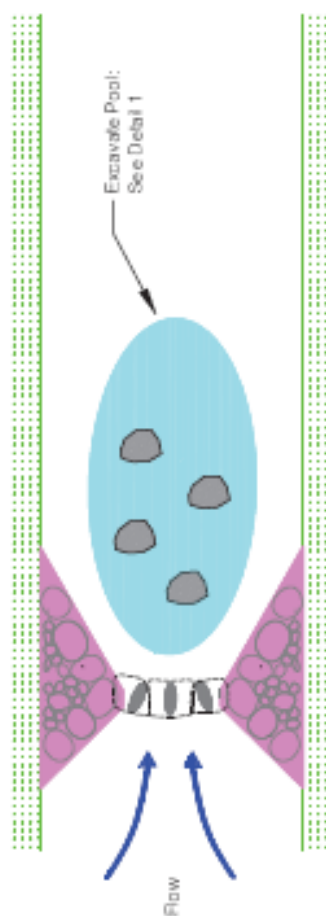


Detail 7: Vortex Stone Weir

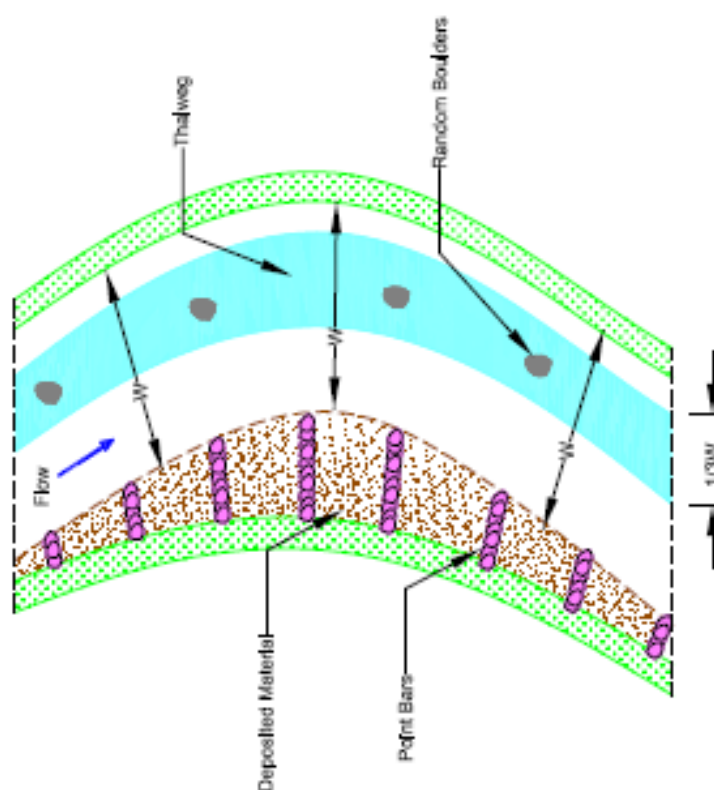


NOTES:

1. Stone deflectors or a series of rocks are built into both banks to direct flow towards centre of channel
2. A line of foster stones, arched upstream are buried across the central channel area. These foster stones to be buried so the surface is flush with bed of the channel
3. These weir rocks are placed on top of the foster stones. The tops of these rocks are exposed by a few centimeters in low flow and are fully submerged in high flow.
4. Foster stones should ideally have a flat flagstone profile, which are larger than the weir stones and form a splash apron to prevent scour
5. Excavate a pool downstream of the weir (see Detail 1: Centre Channel Pool)



Detail 8: Point Bars



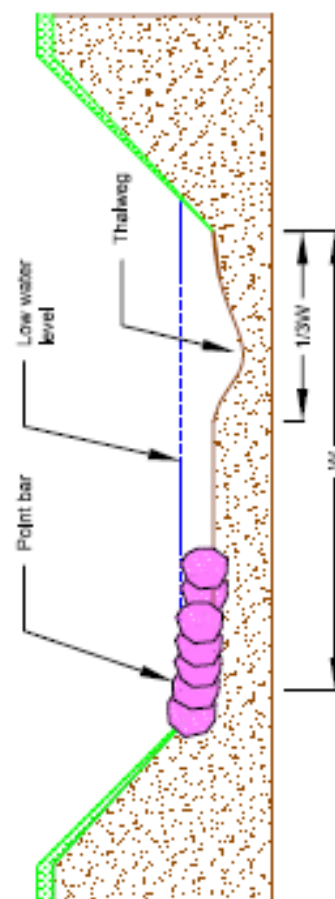
NOTES:

Deflector construction on bends:

1. Typically point bars should be constructed for approximately 1/3 channel basewidth
2. The outer lip of the point bars should form a contour which is parallel to the opposite bank
3. Typically point bars should be spaced approximately 10m apart and built at right angles to the bank (See J1 design for spacing)
4. Excavate a trench along the line of the point bars. Boulders of approximately 0.5 tonnes should be placed into the trench so that they are partially buried into the trench
5. Slope each baffle such that the boulder closest the bank protrudes slightly above low water level and the boulder at the outer edge of the point bar should protrude slightly below low water level

Thalweg

1. Place excavated material from the thalweg between the baffles
2. Place random boulders into the thalweg



4.0 Mitigation and Monitoring

4.1 Environmental Management System

All works carried out as part of this Programme are done in accordance with OPW's Environmental Management Protocols and Standard Operating Procedures.

Environmental River Enhancement Programme

The Arterial Drainage Maintenance Service of Engineering Services, OPW is carrying out the Environmental River Enhancement Programme (EREP). The enhancement works consist of both capital enhancement and enhanced maintenance. These works focus on river corridor improvements to salmonid channels with target specific actions on 100 kilometres of Scheme channel per annum, with pre and post measurement of biodiversity taking place on the channels in the relevant sub-catchments scheduled to benefit from these works. The identification of these channels, the carrying out of biodiversity assessments, the preparation of a five year programme of work and post biodiversity change assessments forms part of the work programme to be delivered by the service provider i.e. Inland Fisheries Ireland. It also involves making the assessment data available in a form that will allow completion of hydromorphological assessments.

The enhancement works are being carried out using OPW staff and machinery with the IFI's staff working alongside OPW supervisory staff. All materials required for the construction of in-stream structures, gravel and fencing is being supplied by OPW.

Environmental Training

Environmental training of all staff is an ongoing process. Technical and Operational Staff have completed formal training in environmental river maintenance in 2004, and again in 2010 which contained the more recent environmental practice. This training was developed and delivered by Inland Fisheries Ireland as part of the EREP. The training programme delivered included presentations in river corridor ecology, maintenance strategies involving both 'enhanced maintenance' and 'capital enhancement', and OPW's Environmental Management Protocols and SOPs.

The formal approach to EREP Training is complimented with on-site training. Regular site visits from IFI and OPW's Environment Section provide further guidance and advice to operational staff. Auditing of operational staff on the implementation of the Environmental Drainage Maintenance Guidance Notes (Ten Steps to Environmentally Friendly Maintenance) is also carried out under EREP.

In addition, other environmental training takes place as deemed beneficial, e.g. in 2008, the majority of operational staff were trained in Otter Awareness. This course, provided by the Department of Zoology, Trinity College Dublin, included presentations on otter ecology, and on-site identification of otter signs and suitable habitat.

Geographical Information Systems (GIS)

GIS systems are now a significant tool to manage both the existing and future environmental information and to this effect, the Drainage Maintenance Service has recently digitised the original Drainage Scheme maps. GIS systems allow the rapid and accurate transfer of geographical environmental data and it is hoped to contain

all maintenance work programmes, fishery information such as spawning reaches, environmentally designated areas e.g. SACs, other sensitive sites such as habitats of protected species and general habitat information in this format.

Ecological Impact Assessments

The annual Arterial Drainage Maintenance Programme is screened for potential impacts on Natura 2000 Sites. Channels identified as having the potential to impact on a Natura 2000 Sites are subject to Appropriate Assessment under Article 6(3) of the Habitats Directive. These Appropriate Assessments are carried out by external Ecological Consultants.

Recent practice for any new localised flood alleviation project is to carry out an Appropriate Assessment if the works overlap with a Natura 2000 Site or an ecological assessment if the works are not within a Natura 2000 Site but still need to have regard to the broader protected habitats and species such as Annex IV species, Wildlife Acts or Flora Protection Order.

Environmental Impact Assessments

European Communities (Environmental Impact Assessment) Regulations, 1989 to 2006 transposes the EIA requirements with recent further changes to the EIA thresholds been introduced through the Planning and Development (Amendment) (No. 2) Regulations 2011. The most applicable class of development relevant to drainage maintenance and 'Designation' projects is in respect of Canalisation. The thresholds are where canalisation and flood relief works, where the immediate contributing sub-catchment would exceed 500 hectares or where more than 2 hectares of wetland would be affected or where the length of river channel on which works are proposed would be greater than 2 km.

Arterial drainage maintenance works are considered to be sub-Environmental Impact Assessment threshold as the operations are maintaining the river corridor but are not canalising any new lengths.

Planning & Development

While there is an extensive range of Planning and Development legislation, the most applicable current legislation is the Planning and Development Regulations, 2001 and the Planning & Development Acts 2000 to 2010. This legislation exempts from planning permission, works under an Arterial Drainage Scheme. These drainage works and the associated maintenance, forming part of a scheme have been confirmed by a Minister and have gone through a public exhibition process in accordance with the Arterial Drainage Acts 1945 and 1995.

4.2 Monitoring Programme

Monitoring of this Programme is made up of two components. The first addresses the on-site implementation of OPW's Environmental Management Protocols and Standard Operating Procedures. The second is a scientific monitoring programme, carried out under the EREP, assessing the impacts of routine maintenance and 'capital enhancement' projects on the river corridor biodiversity.

Auditing

External auditing of operational staff, on the implementation of the Environmental Drainage Maintenance (EDM) Guidance Notes (Ten Steps to Environmentally Friendly Maintenance), is carried out by Inland Fisheries Ireland, as part of the EREP. These audits inform the OPW of the level of compliance with the Environmental Management Protocols and Standard Operating Procedures, with particular focus on the EDM Guidance Notes. External auditing covers approximately one-third of OPW drainage machine crews annually.

Auditing (both internal and external) provides an opportunity to assess the level of compliance with Environmental Management Protocols and SOPs. It also allows for discussion on any difficulties encountered and experimental works that could be applied. The OPW Foreman is present throughout the audit along with the entire machine gang. A section of recently maintained channel is examined along with the next section to be maintained. This gives a good idea of pre-maintenance conditions and enables recommendations to be made about maintenance should proceed, should changes be required. The audit form is forwarded to the relevant Engineer within 14 days upon a satisfactory audit. If the audit highlights unsatisfactory compliance with the OPW Environmental Drainage Maintenance guidelines and SOPs the relevant OPW Engineer is notified within 24 hours.

A rating system was developed and is recorded in OPW's Internal Management System. Ratings are monitored by both IFI and OPW to identify any issues with particular machine crews, or any difficulties with particular aspects environmental maintenance.

Audit Ratings

Rating %	Category
0-50	Bad
51-59	Poor
60-70	Moderate
71-84	Good
85-100	Very Good

Audit results are reported to OPW Management Staff throughout the year and presented in the IFI's Annual EREP report. Presentations are delivered on the auditing and recommended improvements at an annual meeting had with IFI's EREP Team and OPW's Engineers, Technicians and Foremen.

Internal auditing is carried out by OPW's Environment Section. A number of OPW/IFI audits are carried out in tandem annually for standardisation purposes. A standard audit form is used by both IFI and OPW's Environment Section (**OPW Site Audit Form V.1**).

OPW Site Audit Form V.1										
OPW Region:				Scheme:						
Foreman:				Channel: (name & code)						
Driver(s)				Section: (chg-chg)						
Auditor:				Date & Time:						
Site surveyed from:	LHB		RHB	Photographs:						
GPS Ref:				Water level:						
				Machine number:						
				Red book	present	<input type="checkbox"/>	absent	<input type="checkbox"/>		
				Spill kit	present	<input type="checkbox"/>	absent	<input type="checkbox"/>		
Wetted/Base width (<1m, 1-3m, 3-6m, 6-10m, 10-15m, >15m)										
Velocity rating (slow, moderate, fast, flood)				Weather conditions:						
Bed type										
200m minimum maintained section walked?				If not, what distance walked?						
200m unmaintained section walked?				If not, what distance walked?						
Suitable habitat in reach? YES NO				Crayfish (in spoil)	Abundant	<input type="checkbox"/>	Common	<input type="checkbox"/>	Rare	<input type="checkbox"/>
Annex spp./habitats (Recorded on site)				Lamprey (in spoil)	Abundant	<input type="checkbox"/>	Common	<input type="checkbox"/>	Rare	<input type="checkbox"/>
				Abundant (>11 individuals), Common (5 - 10 individuals), Rare (1 - 4 individuals) per 5m ² of bank top						
				Floating-leaved vegetation	Abundant	<input type="checkbox"/>	Common	<input type="checkbox"/>	Rare	<input type="checkbox"/>
				Circle % cover in reach: Abundant (30-70% cover), Common (3-10% cover), Rare (< 3% cover)						
Invasive Species	Species Name:									
% cover in reach: Abundant (30-70% cover), Common (3-10% cover), Rare (< 3% cover)				Abundant	<input type="checkbox"/>	Common	<input type="checkbox"/>	Rare	<input type="checkbox"/>	
Exercising Due Diligence (Skipped Section)	<input type="checkbox"/>									
Maintenance Constraints:				Working Bank	Woodland	Tillage	Fencing			
				Non Working Bank	Woodland	Tillage	Fencing			
Comments on Audit Findings:										
Outstanding Issues:										
Result: _____										
				Compliant	Grade 1	Grade 2	Grade 3			
1. PROTECTING BANK SLOPES				Applicable	<input type="checkbox"/>	<input checked="" type="checkbox"/>	%	%	%	
1.1: Has the non-working bank been disturbed? (slope and Bankfull)							10-15	15-30	30-100	
1.2: Has the working bank slope been disturbed? (mechanically)							15-30	30-60	60-100	
Re profiling	<input type="checkbox"/>	Scraping	<input type="checkbox"/>	Inappropriate bank protection	<input type="checkbox"/>	Fine material	<input type="checkbox"/>			
Other (list):										
2. CONFINING WORKS TO CHANNEL CENTRE				Applicable	<input type="checkbox"/>	<input checked="" type="checkbox"/>	%	%	%	
2.1: Is maintenance retaining 10-15% channel width vegetation on the working margins				See Section 4						
2.2: Is maintenance retaining 10-15% channel width vegetation on the non-working margins										
2.3: Is the quantity/type of spoil being removed appropriate?							10 - 20	20-30	>30	
Gravel/cobble	<input type="checkbox"/>	Marl/boulder clay	<input type="checkbox"/>	Dragging gravel to margins	<input type="checkbox"/>					
2.4: Is spoil is checked for lamprey/crayfish at least 3 times a day as per SOPs? Yes/No				See Section 4.4 - 4.5 for Tall Reeds/Flaggers			moderate	poor	none	
3. Spoil Management				Applicable	<input type="checkbox"/>	<input checked="" type="checkbox"/>	%	%	%	
3.1 Is spoil being placed in the best location? Spoil heap/bank top				<input type="checkbox"/>			70-50	50-30	<30	
W/ bank slope	<input type="checkbox"/>	NW/bank slope	<input type="checkbox"/>	Inside fence	<input type="checkbox"/>	Spoil spread on NW/bank slope the only option? Yes <input type="checkbox"/> No <input type="checkbox"/>				
Is spoil visibly slipping back into channel? Restrictions:				<input type="checkbox"/>						
3.2: Is spoil spread thinly ?							moderate	poor	Bad	
3.3: Is driver allowing water to drain from bucket? (observe driver for 3 minutes; if possible)							40-60	<40		

	Applicable	Compliant	Grade 1	Grade 2	Grade 3
4. Vegetation Management	Applicable	✓	%	%	%
Timing					
4.1 Outside coarse fish spawning season (April 1st to July 1st) <i>If Relevant</i>					
Tall Reeds/Flaggers	Relevant				
4.2 Is vegetation management Interfering with nesting birds (March 1st to Aug 3 1st: Wildlife Act)		YES	NO		
4.3 Is maintenance opening the centre of the channel ONLY? (maximum open area is 75-80% of width)			80-70	70-50	<50
4.4: Where crayfish are present, are additional wider areas of vegetation being retained? (1/3 channel width retained)				20-15	<10
4.5: Where lamprey are present, are additional wider areas of vegetation being retained?(1/3 channel width retained)				20-15	<10
Floating-leaved vegetation (Annex habitat)	Relevant				
Ranunculus sp. (% cover =) Pondweed sp. (% cover =)					
4.6: Is maintenance attempting to remove floating pondweed with the normal bucket?		NO	YES		
4.7: Is floating leave pondweed being skipped/retained? (Retain 50-33% of total reach)			33 - 25	25-15	<15
4.8: Is ranunculus being retained/skipped in the Channel? (Retain 50-33% of total reach)			33 - 25	25-15	<15
Water celery/cress:	Relevant				
4.9: Is the driver skimming off water celery vegetation only?	100-60		60-40	<40	
4.10: Is there an avoidance of digging the channel bed?			60-40	<40	
4.11: Is the driver trying to retain water celery on margins?	100-60		60-40	<40	
4.12: The driver is implementing enhanced maintenance in a channel with <1m base width					
Weed-cutting boat/bucket	Relevant				
4.13: Is it cutting the channel centre vegetation ONLY? (maximum open area is 75-80% of width)			70-50	50-30	<30

	Applicable	Compliant	Grade 1	Grade 2	Grade 3
5. Skipping Sections (Where appropriate)	Applicable	✓			
5.1: Were appropriate sections skipped?	YES				
5.2: Reason for skipping:					
Maintenance not required	<input type="checkbox"/>	Power cables	<input type="checkbox"/>	Good Gradient	<input type="checkbox"/>
Kingfisher/ Swan nest	<input type="checkbox"/>	Gravel section	<input type="checkbox"/>	Otter holt	<input type="checkbox"/>
Swan & Duck Mussels	<input type="checkbox"/>	Wetlands - Bogs, Fens & Turloughs	<input type="checkbox"/>	Freshwater Pearl Mussel	<input type="checkbox"/>
Other (list):		Invasive Plants Species	<input type="checkbox"/>	Channel not accessible	<input type="checkbox"/>

	Applicable	Compliant	Grade 1	Grade 2	Grade 3
6. Tree Management	Applicable	✓	%	%	%
Timing					
6.1 Appropriate tree management is only permissible from September 1st to February 28th under the Wildlife Act					
Tree cutting					
6.2 What is the purpose of the tree cutting?					
Conveyance <input type="checkbox"/> habitat enhancement <input type="checkbox"/> access <input type="checkbox"/> Other (list)					
6.3 What equipment is being used?				Machine bucket	
Secateurs <input type="checkbox"/> chain saw <input type="checkbox"/> hand saw <input type="checkbox"/> Tree shears <input type="checkbox"/>					
6.4 How much tree cover is being retained on the banks in the channel reach?			70-50	50-25	<25
removing fallen/low trees <input type="checkbox"/> opening sections over riffles <input type="checkbox"/> Selective tree cutting <input type="checkbox"/> opening limited sections for access <input type="checkbox"/>					
Other (list):					
6.5: Is tree cutting retaining the variety of trees present/diversity?					
6.6: Is tree cutting retaining a diversity of bankside vegetation? (trees/Scrub/Shrub)					
6.7: Manage scrub - Otter & Birds SOP			80-70	70-50	
6.8: Woody habitat placed in field / bank slope/top as wildlife refuges?					
6.9: Avoidance of damage to tree cover during the closed season					

	Applicable	Compliant	Grade 1	Grade 2	Grade 3
7. Berm Management	Applicable	✓			
7.1: Retain berms (no maintenance)					
7.2 Managed to the basic berm protocol?			80-70	70-50	<50
7.3 Berm re-sodding done where appropriate (berm width / sod character)					
Gravel Berm					
7.4: How gravel berm has been managed?			moderate	poor	bad
gravel drawn to bank toe <input type="checkbox"/> gravel removed from channel <input type="checkbox"/> Gravel used downstream in channel <input type="checkbox"/>					
Other (list):					

	Applicable	Compliant	Grade 1	Grade 2	Grade 3
8. Replacing stone and boulders back in the channel	Applicable	✓	%	%	%
8.1: Are materials being returned to the channel (boulders/cobble/gravel) from diggings?				70-50	<50
8.2: Is readily available and appropriately sized stone from adjoining locations being placed into the channel?			60-40	<40	
8.3: Is there a reason for not placing stone material into the channel, if stone available?		No			
If Yes (List):					

	Applicable	Compliant	Grade 1	Grade 2	Grade 3
9. Gravel Bed Channels	Applicable	✓	%	%	%

9.1: Is instream maintenance taking place between 1st July and 30th September, without consultation with IFI?					
9.2: Loosen or toss bed gravels to wash out fines			70-40	<40	
9.3: Are measures present to prevent sediment and silt flowing downstream between Autumn-Spring?					

	Compliant	Grade 1	Grade 2	Grade 3
10. New Excavations in the channel - simple structures	✓	%	%	%
10.1: Is the bed being excavated to form deeper pool areas and shallow riffles?		70-50	<50	
10.2: Is the channel being deepened on one side and spoil placed on the opposite side?		70-50	<50	
Opportunity to use existing spoil to form simple structures?	✓	%	%	%
10.3. Alternating/ paired deflectors		70-50	<50	
Rubble mat				
Simple weir				
Random boulder array				

Count No of Applicable Steps:

Scoring for Applicable sections:	Totals:				
----------------------------------	---------	--	--	--	--

< 4 Steps	Total Marks	Total score
1 Yellow = -15		
1 Orange = -30		
1 Red = -70		
Total Negative Mark		
1 Green = +15%		
Total Positive Mark		

To Calculate Score: 100 - (Total Negative Mark + Total Positive Mark)

This score represents % compliance (a negative is possible)

Example: No of Sections: 6, Scores: 1 Orange, 2 yellow and 1 Green Mark

(1 orange = -25, 2 yellow = -20, 1 green = +10, ∴ Total = -35

100 - 35 = 65

Total Score
Compliance =

Between 5 - 7 Steps	Total Marks	Total score
1 Yellow = -10		
1 Orange = -25		
1 Red = -70		
Total Negative Mark		
1 Green = +10%		
Total Positive Mark		

Total Score
Compliance =

Between 8 - 10 Steps	Total Marks	Total score
1 Yellow = -10		
1 Orange = -20		
1 Red = -70		
Total Negative Mark		
1 Green = +10%		
Total Positive Mark		

Total Score
Compliance =

Ratings

0 - 50 = Bad

51 - 59 = Poor

60 - 70 = Moderate

71 - 84 = Good

85 - 100 = Very good

Additional Comments:

Scientific Monitoring

The EREP biological monitoring programme assesses the impacts of routine maintenance and 'capital enhancement' projects on the river corridor biodiversity. Fish, flora, birds, macro-invertebrates, lamprey and crayfish are monitored across a selection of sites. The physical changes in the channels are also monitored. Monitoring of these aspects have been ongoing to varying degrees as a component to the EREP project. Results have showed considerable variance and for some elements, difficult to show definitive trends. Monitoring is reviewed periodically and altered as required.

River Corridor Biodiversity

EREP monitoring to date has indicated that often changes seen across the whole site can be interlinked. Enhancement of the physical regime can greatly improve channel diversity, through the creation of riffle/glide/pool sequences, addition of spawning gravels and bank protection.

Physical changes to the channel often result in changes in the floral communities, as a more diverse bed material is available. Species such as *Ranunculus* and *Scirpus* tend to favour gravely bed material will softer sediment attracts species like *Sparganium*.

Changes to the aquatic, marginal and riparian vegetation can often result in changes to the invertebrate communities. Increased vegetation cover and diversity often correspond with increased invertebrate diversity and abundance.

Physical Monitoring

Physical monitoring includes pre and post works monitoring of a number of variables. Variables measured include bank-full width, wetted width, channel length, depth velocity and canopy cover.

The Water Framework Directive (WFD) requires information on hydromorphological conditions, along with biological quality and physio-chemical conditions, in order to determine the ecological status of any given water-body. A classification of 'High Ecological Status' cannot be assigned to a water-body unless the hydromorphological conditions are high also. If the hydromorphological condition of a water-body has not been determined and the system has been subject to drainage, then that catchment is deemed to be "probably at risk". Therefore the EREP has included monitoring of hydromorphology in its monitoring programme.

The River Hydromorphology Assessment Technique (RHAT) monitoring system has been approved as the appropriate method to determine hydromorphological status of a channel and is being used for WFD monitoring.

RHAT is used to monitor hydromorphological condition of a selection of channels under EREP. The data collected will feed back to the Environmental Protection Agency (EPA) and contribute to the overall national assessments on channel morphology.

Floral Monitoring

Three vegetation types are surveyed under the floral monitoring programme. These include:

- Aquatic (in-channel) vegetation
- Marginal vegetation
- Riparian vegetation

A walkover survey of the entire site is used to compile a species inventory of riparian and in-stream species. Quantitative assessments are also carried out within the sites. Tree surveys also form part of this monitoring process and include information of composition and abundance of tree cover.

Macro-invertebrate Monitoring

The macro-invertebrate communities of a river respond quickly to change and are a good reflection of conditions in the short term. Their assemblages reflect changes in habitat as well as changes in water quality, as most species have a preference for either fast or slow flowing water, sheltered or exposes areas and silt or cobbles. Sampling is carried out at both experimental and control sites, and a species inventory list compiled.

Fish Sampling

While the primary focus for the EREP fish stock survey is on salmon and brown trout, data from all species encountered during surveys are recorded. Data collected provides information on population, distribution, age-structure for any species encountered.

Bird Population Studies

Bird surveys are carried out a selection of sites, using standard survey methods used by Bird Watch Ireland and other relevant agencies. The key objectives of the bird studies are to:

- Record the abundance, species richness and distribution of bird species in OPW channels, and
- Assess the impacts of drainage and drainage maintenance on bird species based on this data.

To this end, surveying is conducted on:

- Various habitat types within the river corridor.
- Sites pre and post maintenance.
- Non-drained channels and drained channels

Lamprey & Crayfish Studies

OPW funded studies to examine the effects of Arterial Drainage Maintenance operations on lamprey and white-clawed crayfish have been ongoing since 2006. Ecological Impact Assessments (EclA) were carried out on both species, by the then Central Fisheries Board. Further research was recommended in these EclAs, which resulted in the continuation of studies of both species as part of the EREP. Surveying of both species includes monitoring of population size and age structure, prior to, and in a series of years post maintenance.

B Appendix - Natura 2000 Sites included in Screening

Table 5-1. Summary table of Natura 2000 sites potentially impacted by drainage maintenance activities

Natura 2000 sites	Relevant scheme	Natura 2000 Sites within 15km radius of OPW Scheme	FWPM is a QI of this Natura 2000 site	FWPM sensitive area within 3kms upstream or 35kms downstream of scheme	GWDTE a QI of Natura 2000 site
Akeragh, Banna And Barrow Harbour SAC (000332)	Feale	Yes	No	Yes	Yes
Anglesey Road SAC (002125)	Carrick-on-suir	No	No	Yes	No
Ardagullion Bog SAC (002341)	Inny - Upper Shannon (E and F) Catchments	Yes	No	No	Yes
Ardgraique Bog SAC (002356)	Carrigahorig	Yes	No	No	Yes
	Clareen	No	No	No	Yes
	Killimor	Yes	No	No	Yes
	Nenagh	No	No	No	Yes
	Woodford	No	No	Yes	Yes
Ardkill Turlough SAC (000461)	Corrib	Yes	No	No	No
Ardmore Head SAC (002123)	Brickey	Yes	No	No	No
Ardrahan Grassland SAC (002244)	Gort	Yes	No	No	No
	Lacken	Yes	No	No	No
Arroo Mountain SAC (001403)	Abbey	Yes	No	No	Yes
	Bonet	Yes	No	No	Yes
	Duff	Yes	No	No	Yes
	Kilcoo	Yes	No	No	Yes
Askeaton Fen Complex SAC (002279)	Deel	Yes	No	No	Yes
	Maigue	Yes	No	No	Yes
	Maigue Outfall	Yes	No	No	Yes

Natura 2000 sites	Relevant scheme	Natura 2000 Sites within 15km radius of OPW Scheme	FWPM is a QI of this Natura 2000 site	FWPM sensitive area within 3kms upstream or 35kms downstream of scheme	GWDTE a QI of Natura 2000 site
	Shannon Embankments South	Yes	No	No	Yes
Aughris Head SPA (004133)	Bonet	No	No	No	No
Baldoyle Bay SAC (000199)	Hazelhatch (Sinkeen) Scheme	No	No	No	No
	Ryewater	No	No	No	No
Baldoyle Bay SPA (004016)	Hazelhatch (Sinkeen) Scheme	No	No	No	Yes
	Ryewater	No	No	No	Yes
Balla Turlough SAC (000463)	Moy	No	No	Yes	No
Ballinafad SAC (002081)	Moy	No	No	Yes	No
Ballinduff Turlough SAC (002295)	Gort	Yes	No	No	No
	Lacken	Yes	No	No	No
Ballinskelligs Bay And Inny Estuary SAC (000335)	Ouvane	No	No	Yes	No
Ballintemple and Ballygilgan SPA (004234)	Bonet	No	No	No	No
Ballinturly Turlough SAC (000588)	Ballyglass (Knockcrohery) Scheme	Yes	No	No	No
	Inny - Upper Shannon (E and F) Catchments	No	No	No	No
Ballyallia Lake SAC (000014)	Shannon embankments North	No	No	No	No
	Sixmilebridge	No	No	No	No
Ballyallia Lough SPA (004041)	Shannon embankments North	No	No	No	Yes
	Sixmilebridge	No	No	No	Yes
Ballyarr Wood SAC (000116)	Donegal Swilly embankments, Blanket Nook, Bridge End FRS and Skeoge & Burnfoot embankment schemes	Yes	No	No	No

Natura 2000 sites	Relevant scheme	Natura 2000 Sites within 15km radius of OPW Scheme	FWPM is a QI of this Natura 2000 site	FWPM sensitive area within 3kms upstream or 35kms downstream of scheme	GWDTE a QI of Natura 2000 site
Ballycullinan Lake SAC (000016)	Shannon embankments North	No	No	No	No
	Sixmilebridge	No	No	No	No
Ballycullinan, Old Domestic Building SAC (002246)	Shannon embankments North	No	No	No	No
	Sixmilebridge	No	No	No	No
Ballyhoorisky Point To Fanad Head SAC (001975)	Donegal Swilly embankments, Blanket Nook, Bridge End FRS and Skeoge & Burnfoot embankment schemes	No	No	No	Yes
Ballyhoura Mountains SAC (002036)	Maigue	Yes	No	No	No
	Maigue Outfall	No	No	No	No
	Shannon Embankments South	No	No	No	No
Ballymaglancy Cave, Cong SAC (000474)	Corrib	Yes	No	No	No
Ballymore Fen SAC (002313)	Inny - Upper Shannon (E and F) Catchments	Yes	No	No	Yes
Ballyogan Lough SAC (000019)	Shannon embankments North	No	No	No	No
	Sixmilebridge	No	No	No	No
Ballysadare Bay SAC (000622)	Bonet	Yes	No	No	Yes
Ballysadare Bay SPA (004129)	Bonet	Yes	No	No	Yes
Ballyseedy Wood SAC (002112)	Feale	Yes	No	Yes	No
Ballyteige (Clare) SAC (000994)	Cloghauinchy	No	No	No	No
	Creegh	No	No	No	No
Ballyteige Burrow SAC (000696)	Ballyteigue Kilmore Embankment and Drainage Scheme	Yes	No	No	No
Ballyteige Burrow SPA (004020)	Ballyteigue Kilmore	Yes	No	No	Yes

Natura 2000 sites	Relevant scheme	Natura 2000 Sites within 15km radius of OPW Scheme	FWPM is a QI of this Natura 2000 site	FWPM sensitive area within 3kms upstream or 35kms downstream of scheme	GWDTE a QI of Natura 2000 site
	Embankment and Drainage Scheme				
Ballyvaughan Turlough SAC (000996)	Gort	No	No	No	No
	Lacken	No	No	No	No
Bandon River SAC (002171)	Bandon River (Dunmanway)	Yes	Yes	Yes	No
Bannow Bay SAC (000697)	Ballyteigue Kilmore Embankment and Drainage Scheme	Yes	No	No	No
Bannow Bay SPA (004033)	Ballyteigue Kilmore Embankment and Drainage Scheme	Yes	No	No	Yes
Barley Cove To Ballyrisode Point SAC (001040)	Bandon River (Dunmanway)	No	No	Yes	No
	Ouvane	No	No	Yes	No
Barrigone SAC (000432)	Deel	Yes	No	No	No
	Maigue	Yes	No	No	No
	Maigue Outfall	No	No	No	No
	Shannon Embankments South	Yes	No	No	No
Barroughter Bog SAC (000231)	Carrigahorig	Yes	No	No	Yes
	Clareen	Yes	No	No	Yes
	Killimor	Yes	No	No	Yes
	Nenagh	No	No	No	Yes
	Woodford	Yes	No	Yes	Yes
Beara Peninsula SPA (004155)	Ouvane	No	No	Yes	No
Bellacorick Bog Complex SAC (001922)	Moy	Yes	No	Yes	Yes

Natura 2000 sites	Relevant scheme	Natura 2000 Sites within 15km radius of OPW Scheme	FWPM is a QI of this Natura 2000 site	FWPM sensitive area within 3kms upstream or 35kms downstream of scheme	GWDTE a QI of Natura 2000 site
Bellanagare Bog SAC (000592)	Boyle	No	No	No	Yes
Bellangare Bog SPA (004105)	Boyle	No	No	No	No
Ben Bulbin, Gleniff And Glenade Complex SAC (000623)	Abbey	No	No	No	Yes
	Bonet	Yes	No	No	Yes
	Duff	Yes	No	No	Yes
	Kilcoo	Yes	No	No	Yes
Black Head-Poulsallagh Complex SAC (000020)	Cloghauinchy	No	No	No	Yes
	Creegh	No	No	No	Yes
	Gort	No	No	No	Yes
	Lacken	No	No	No	Yes
Blackwater River (Cork/Waterford) SAC (002170)	Brickey	Yes	Yes	No	No
Blackwater River (Kerry) SAC (002173)	Ouvane	No	Yes	Yes	No
Blasket Islands SAC (002172)	Maine	No	No	Yes	No
Boleybrack Mountain SAC (002032)	Abbey	No	No	No	No
	Bonet	Yes	No	No	No
	Duff	No	No	No	No
	Kilcoo	Yes	No	No	No
Bolingbrook Hill SAC (002124)	Carrigahorig	No	No	No	No
	Clareen	No	No	No	No
	Groody	No	No	No	No
	Killimor	No	No	No	No
	Mulkear Ballymackeogh	No	No	No	No
	Mulkear Cappamore	No	No	No	No

Natura 2000 sites	Relevant scheme	Natura 2000 Sites within 15km radius of OPW Scheme	FWPM is a QI of this Natura 2000 site	FWPM sensitive area within 3kms upstream or 35kms downstream of scheme	GWDTE a QI of Natura 2000 site
	Nenagh	Yes	No	No	No
	Woodford	No	No	Yes	No
Boyne Coast And Estuary SAC (001957)	Boyne	Yes	No	No	No
	Glyde and Dee	Yes	No	No	No
Boyne Estuary SPA (004080)	Boyne	Yes	No	No	Yes
	Glyde and Dee	Yes	No	No	Yes
Bricklieve Mountains & Keishcorran SAC (001656)	Bonet	Yes	No	No	No
Bunduff Lough And Machair/Trawalua/Mullaghmore SAC (000625)	Abbey	Yes	No	No	Yes
	Bonet	Yes	No	No	Yes
	Duff	Yes	No	No	Yes
	Kilcoo	No	No	No	Yes
Caha Mountains SAC (000093)	Ouvane	Yes	No	Yes	No
Caherglassaun Turlough SAC (000238)	Gort	Yes	No	No	Yes
	Lacken	Yes	No	No	Yes
Cahermore Turlough SAC (002294)	Gort	Yes	No	No	No
	Lacken	Yes	No	No	No
Cahore Marshes SPA (004143)	Owenavorrigh	Yes	No	No	Yes
Cahore Polders And Dunes SAC (000700)	Owenavorrigh	Yes	No	No	No
Callow Bog SAC (000595)	Boyle	No	No	No	Yes
Carlingford Lough SPA (004078)	Glyde and Dee	No	No	No	Yes
Carlingford Mountain SAC (000453)	Glyde and Dee	No	No	No	Yes
Carlingford Shore SAC (002306)	Glyde and Dee	No	No	No	No
Carn Park Bog SAC (002336)	Ballyglass (Knockcrohery)	No	No	No	Yes

Natura 2000 sites	Relevant scheme	Natura 2000 Sites within 15km radius of OPW Scheme	FWPM is a QI of this Natura 2000 site	FWPM sensitive area within 3kms upstream or 35kms downstream of scheme	GWDTE a QI of Natura 2000 site
	Scheme				
	Inny - Upper Shannon (E and F) Catchments	Yes	No	No	Yes
Carnsore Point SAC (002269)	Ballyteigue Kilmore Embankment and Drainage Scheme	Yes	No	No	No
Carrowbaun, Newhall And Ballylee Turloughs SAC (002293)	Gort	Yes	No	No	No
	Lacken	Yes	No	No	No
Carrowkeel Turlough SAC (000475)	Corrib	Yes	No	No	No
Carrowmore Dunes SAC (002250)	Cloghauinchy	Yes	No	No	Yes
	Creegh	Yes	No	No	Yes
Carrowmore Point To SPANish Point And Islands SAC (001021)	Cloghauinchy	Yes	No	No	Yes
	Creegh	Yes	No	No	Yes
Castlemaine Harbour SAC (000343)	Maine	Yes	No	Yes	Yes
Castlemaine Harbour SPA (004029)	Maine	Yes	No	Yes	Yes
Castletaylor Complex SAC (000242)	Gort	Yes	No	No	No
	Lacken	Yes	No	No	No
Castletownshend SAC (001547)	Bandon River (Dunmanway)	No	No	Yes	No
Charleville Wood SAC (000571)	Brosna Arterial Drainage and Embankment Scheme	Yes	No	No	Yes
Clara Bog SAC (000572)	Brosna Arterial Drainage and Embankment Scheme	Yes	No	No	Yes
Clare Glen SAC (000930)	Groody	Yes	No	No	No
	Mulkear Ballymackeogh	Yes	No	No	No

Natura 2000 sites	Relevant scheme	Natura 2000 Sites within 15km radius of OPW Scheme	FWPM is a QI of this Natura 2000 site	FWPM sensitive area within 3kms upstream or 35kms downstream of scheme	GWDTE a QI of Natura 2000 site
	Mulkear Cappamore	Yes	No	No	No
Cleanderry Wood SAC (001043)	Ouvane	No	No	Yes	No
Cliffs of Moher SPA (004005)	Cloghauinchy	No	No	No	No
	Creegh	No	No	No	No
Clogher Head SAC (001459)	Glyde and Dee	Yes	No	No	No
Cloghernagore Bog And Glenveagh National Park SAC (002047)	Donegal - Cloonburn Arterial Drainage Scheme and Deel & Swillyburn Estuarine Embankment scheme	No	Yes	No	No
	Donegal Swilly embankments, Blanket Nook, Bridge End FRS and Skeoge & Burnfoot embankment schemes	Yes	Yes	No	No
Clonakilty Bay SAC (000091)	Bandon River (Dunmanway)	No	No	Yes	No
Clonakilty Bay SPA (004081)	Bandon River (Dunmanway)	No	No	Yes	Yes
Clonaslee Eskers And Derry Bog SAC (000859)	Brosna Arterial Drainage and Embankment Scheme	Yes	No	No	Yes
Cloonakillina Lough SAC (001899)	Bonet	No	No	No	Yes
Cloonee And Inchiquin Loughs, Uragh Wood SAC (001342)	Ouvane	No	No	Yes	No
Cloonmoylan Bog SAC (000248)	Carrigahorig	Yes	No	No	Yes
	Clareen	No	No	No	Yes
	Killimor	No	No	No	Yes
	Nenagh	Yes	No	No	Yes
	Woodford	Yes	No	Yes	Yes

Natura 2000 sites	Relevant scheme	Natura 2000 Sites within 15km radius of OPW Scheme	FWPM is a QI of this Natura 2000 site	FWPM sensitive area within 3kms upstream or 35kms downstream of scheme	GWDTE a QI of Natura 2000 site
Cloonshanville Bog SAC (000614)	Boyle	No	No	No	Yes
Cloughmoyne SAC (000479)	Corrib	Yes	No	No	No
Clyard Kettle-Holes SAC (000480)	Corrib	Yes	No	No	No
Comeragh Mountains SAC (001952)	Brickey	Yes	No	No	Yes
	Carrick-on-suir	Yes	No	Yes	Yes
Connemara Bog Complex SAC (002034)	Corrib	Yes	No	No	Yes
Coole-Garryland Complex SAC (000252)	Gort	Yes	No	No	Yes
	Lacken	Yes	No	No	Yes
Coole-Garryland SPA (004107)	Gort	Yes	No	No	No
	Lacken	Yes	No	No	No
Coolrain Bog SAC (002332)	Kilkenny	No	No	No	Yes
Corbo Bog SAC (002349)	Ballyglass (Knockcrohery) Scheme	Yes	No	No	Yes
	Inny - Upper Shannon (E and F) Catchments	No	No	No	Yes
Corofin Wetlands SPA (004220)	Shannon embankments North	No	No	No	Yes
	Sixmilebridge	No	No	No	Yes
Corratirrim SAC (000979)	Abbey	No	No	No	No
	Duff	No	No	No	No
	Kilcoo	Yes	No	No	No
Courtmacsherry Bay SPA (004219)	Bandon River (Dunmanway)	No	No	Yes	Yes
Courtmacsherry Estuary SAC (001230)	Bandon River (Dunmanway)	No	No	Yes	No
Cregg House Stables, Crusheen SAC (002317)	Shannon embankments North	No	No	No	No

Natura 2000 sites	Relevant scheme	Natura 2000 Sites within 15km radius of OPW Scheme	FWPM is a QI of this Natura 2000 site	FWPM sensitive area within 3kms upstream or 35kms downstream of scheme	GWDTE a QI of Natura 2000 site
	Sixmilebridge	No	No	No	No
Cregganna Marsh SPA (004142)	Gort	No	No	No	No
	Lacken	Yes	No	No	No
Croaghonagh Bog SAC (000129)	Donegal - Cloonburn Arterial Drainage Scheme and Deel & Swillyburn Estuarine Embankment scheme	No	No	No	No
Cuilcagh - Anierin Uplands SAC (000584)	Abbey	No	No	No	Yes
	Duff	No	No	No	Yes
	Kilcoo	No	No	No	Yes
Cullahill Mountain SAC (000831)	Kilkenny	No	No	No	No
Cummeen Strand SPA (004035)	Bonet	Yes	No	No	Yes
Cummeen Strand/Drumcliff Bay (Sligo Bay) SAC (000627)	Bonet	Yes	No	No	Yes
Curraghchase Woods SAC (000174)	Deel	Yes	No	No	No
	Maigue	Yes	No	No	No
	Maigue Outfall	Yes	No	No	No
	Shannon Embankments South	Yes	No	No	No
Danes Hole, Poulnalecka SAC (000030)	Shannon embankments North	Yes	No	No	No
	Sixmilebridge	Yes	No	No	No
Derrinea Bog SAC (000604)	Boyle	No	No	No	Yes
Derryclogher (Knockboy) Bog SAC (001873)	Ouvane	Yes	No	Yes	No
Derrycrag Wood Nature Reserve SAC (000261)	Carrigahorig	No	No	No	No
	Clareen	No	No	No	No

Natura 2000 sites	Relevant scheme	Natura 2000 Sites within 15km radius of OPW Scheme	FWPM is a QI of this Natura 2000 site	FWPM sensitive area within 3kms upstream or 35kms downstream of scheme	GWDTE a QI of Natura 2000 site
	Killimor	Yes	No	No	No
	Nenagh	Yes	No	No	No
	Woodford	Yes	No	Yes	No
Derryveagh And Glendowan Mountains SPA (004039)	Donegal - Cloonburn Arterial Drainage Scheme and Deel & Swillyburn Estuarine Embankment scheme	No	No	No	No
	Donegal Swilly embankments, Blanket Nook, Bridge End FRS and Skeoge & Burnfoot embankment schemes	Yes	No	No	No
Dingle Penninsula SPA (004153)	Feale	No	No	Yes	No
	Maine	Yes	No	Yes	No
Donegal Bay (Murvagh) SAC (000133)	Abbey	Yes	No	No	Yes
Donegal Bay SPA (004151)	Duff	Yes	No	No	Yes
	Kilcoo	No	No	No	Yes
Doocastle Turlough SAC (000492)	Bonet	No	No	No	No
Dromore Woods And Loughs SAC (000032)	Shannon embankments North	No	No	No	Yes
	Sixmilebridge	No	No	No	Yes
Drongawn Lough SAC (002187)	Ouvane	No	No	Yes	No
Drumalough Bog SAC (002338)	Boyle	Yes	No	No	Yes
Drumcliff Bay SPA (004013)	Bonet	Yes	No	No	Yes
Drummin Wood SAC (002181)	Gort	Yes	No	No	No
	Lacken	Yes	No	No	No
Dunbeacon Shingle SAC (002280)	Ouvane	No	No	Yes	No

Natura 2000 sites	Relevant scheme	Natura 2000 Sites within 15km radius of OPW Scheme	FWPM is a QI of this Natura 2000 site	FWPM sensitive area within 3kms upstream or 35kms downstream of scheme	GWDTE a QI of Natura 2000 site
Dundalk Bay SAC (000455)	Glyde and Dee	Yes	No	No	No
Dundalk Bay SPA (004026)	Glyde and Dee	Yes	No	No	Yes
Dungarvan Harbour SPA (004032)	Brickey	Yes	No	No	Yes
Dunmuckrum Turloughs SAC (002303)	Abbey	Yes	No	No	No
	Duff	Yes	No	No	No
	Kilcoo	No	No	No	No
Dunragh Loughs/Pettigo Plateau SAC (001125)	Donegal - Cloonburn Arterial Drainage Scheme and Deel & Swillyburn Estuarine Embankment scheme	No	No	No	No
East Burren Complex SAC (001926)	Gort	Yes	No	No	Yes
	Lacken	Yes	No	No	Yes
	Shannon embankments North	No	No	No	Yes
	Sixmilebridge	No	No	No	Yes
Eirk Bog SPA (004108)	Maine	No	No	Yes	No
Errit Lough SAC (000607)	Boyle	Yes	No	No	No
Fanad Head SPA (004148)	Donegal Swilly embankments, Blanket Nook, Bridge End FRS and Skeoge & Burnfoot embankment schemes	No	No	No	No
Farranamanagh Lough SAC (002189)	Ouvane	No	No	Yes	No
Flughany Bog SAC (000497)	Bonet	No	No	No	Yes
Fortwilliam Turlough SAC (000448)	Ballyglass (Knockcrohery) Scheme	Yes	No	No	No
	Inny - Upper Shannon (E and	Yes	No	No	No

Natura 2000 sites	Relevant scheme	Natura 2000 Sites within 15km radius of OPW Scheme	FWPM is a QI of this Natura 2000 site	FWPM sensitive area within 3kms upstream or 35kms downstream of scheme	GWDTE a QI of Natura 2000 site
	F) Catchments				
Galley Head to Duneen Point SPA (004190)	Bandon River (Dunmanway)	No	No	Yes	No
Galmoy Fen SAC (001858)	Kilkenny	No	No	No	Yes
Galtee Mountains SAC (000646)	Carrick-on-suir	No	No	Yes	No
Galway Bay Complex SAC (000268)	Corrib	Yes	No	No	Yes
	Gort	Yes	No	No	Yes
	Lacken	Yes	No	No	Yes
Garriskil Bog SAC (000679)	Inny - Upper Shannon (E and F) Catchments	Yes	No	No	Yes
Garriskill Bog SPA (004102)	Inny - Upper Shannon (E and F) Catchments	Yes	No	No	No
Glanlough Woods SAC (002315)	Ouvane	Yes	No	Yes	No
Glanmore Bog SAC (001879)	Ouvane	No	Yes	Yes	No
Glen Bog SAC (001430)	Deel	No	No	No	No
	Maigue	Yes	No	No	No
	Maigue Outfall	No	No	No	No
	Shannon Embankments South	No	No	No	No
Glen Lough SPA (004045)	Inny - Upper Shannon (E and F) Catchments	Yes	No	No	No
Glenade Lough SAC (001919)	Bonet	Yes	No	No	No
Glenasmole Valley SAC (001209)	Hazelhatch (Sinkeen) Scheme	Yes	No	No	Yes
	Ryewater	Yes	No	No	Yes
Glendine Wood SAC (002324)	Brickey	Yes	No	No	No
Glendree Bog SAC (001912)	Carrigahorig	No	No	No	No

Natura 2000 sites	Relevant scheme	Natura 2000 Sites within 15km radius of OPW Scheme	FWPM is a QI of this Natura 2000 site	FWPM sensitive area within 3kms upstream or 35kms downstream of scheme	GWDTE a QI of Natura 2000 site
	Clareen	No	No	No	No
	Killimor	No	No	No	No
	Nenagh	No	No	No	No
	Woodford	No	No	Yes	No
Glengarriff Harbour And Woodland SAC (000090)	Ouvane	Yes	No	Yes	No
Glenomra Wood SAC (001013)	Groody	No	No	No	No
	Mulkear Ballymackeogh	Yes	No	No	No
	Mulkear Cappamore	No	No	No	No
Glenstal Wood SAC (001432)	Groody	Yes	No	No	No
	Mulkear Ballymackeogh	Yes	No	No	No
	Mulkear Cappamore	Yes	No	No	No
Gortacarnaun Wood SAC (002180)	Gort	Yes	No	No	No
	Lacken	Yes	No	No	No
Gortnandarragh Limestone Pavement SAC (001271)	Corrib	No	No	No	No
Greaghans Turlough SAC (000503)	Corrib	Yes	No	No	No
Helvick Head SAC (000665)	Brickey	Yes	No	No	No
Helvick Head to Ballyquin SPA (004192)	Brickey	Yes	No	No	No
Hook Head SAC (000764)	Ballyteigue Kilmore Embankment and Drainage Scheme	Yes	No	No	No
Horn Head to Fanad Head SPA (004194)	Donegal Swilly embankments, Blanket Nook, Bridge End FRS and Skeoge & Burnfoot embankment schemes	Yes	No	No	No

Natura 2000 sites	Relevant scheme	Natura 2000 Sites within 15km radius of OPW Scheme	FWPM is a QI of this Natura 2000 site	FWPM sensitive area within 3kms upstream or 35kms downstream of scheme	GWDTE a QI of Natura 2000 site
Howth Head Coast SPA (004113)	Hazelhatch (Sinkeen) Scheme	No	No	No	No
	Ryewater	No	No	No	No
Howth Head SAC (000202)	Hazelhatch (Sinkeen) Scheme	No	No	No	No
	Ryewater	No	No	No	No
Hugginstown Fen SAC (000404)	Carrick-on-suir	Yes	No	Yes	Yes
	Kilkenny	No	No	No	Yes
Inagh River Estuary SAC (000036)	Cloghauinchy	No	No	No	No
	Creegh	No	No	No	No
Inner Galway Bay SPA (004031)	Gort	Yes	No	No	Yes
	Lacken	Yes	No	No	Yes
Iveragh Peninsula SPA (004154)	Maine	Yes	No	Yes	No
Iveragh Penninsula SPA (004154)	Ouvane	No	No	Yes	No
Keeper Hill SAC (001197)	Groody	No	No	No	No
	Mulkear Ballymackeogh	No	No	No	No
	Mulkear Cappamore	Yes	No	No	No
Kenmare River SAC (002158)	Ouvane	No	No	Yes	Yes
Kerry Head SPA (004189)	Feale	Yes	No	Yes	No
Kilcarren-Firville Bog SAC (000647)	Carrigahorig	Yes	No	No	Yes
	Clareen	No	No	No	Yes
	Killimor	Yes	No	No	Yes
	Nenagh	No	No	No	Yes
	Woodford	No	No	Yes	Yes
Kilduff, Devilsbit Mountain SAC (000934)	Carrick-on-suir	No	No	Yes	No

Natura 2000 sites	Relevant scheme	Natura 2000 Sites within 15km radius of OPW Scheme	FWPM is a QI of this Natura 2000 site	FWPM sensitive area within 3kms upstream or 35kms downstream of scheme	GWDTE a QI of Natura 2000 site
	Carrigahorig	No	No	No	No
	Clareen	No	No	No	No
	Killimor	No	No	No	No
	Nenagh	Yes	No	No	No
	Woodford	No	No	Yes	No
Kildun Souterrain SAC (002320)	Corrib	Yes	No	No	No
Kilgarvan Ice House SAC (000364)	Ouvane	No	No	Yes	No
Kilglassan/Caheravoostia Turlough Complex SAC (000504)	Corrib	Yes	No	No	No
Kilkee Reefs SAC (002264)	Cloghauinchy	Yes	No	No	No
	Creegh	Yes	No	No	No
	Shannon embankments North	No	No	No	No
	Sixmilebridge	No	No	No	No
Kilkeran Lake And Castlefreke Dunes SAC (001061)	Bandon River (Dunmanway)	No	No	Yes	No
Kilkishen House SAC (002319)	Shannon embankments North	Yes	No	No	No
	Sixmilebridge	Yes	No	No	No
Killala Bay/Moy Estuary SAC (000458)	Moy	No	No	Yes	Yes
Killala Bay/Moy Estuary SPA (004036)	Moy	No	No	Yes	Yes
Killarney National Park SAC (004038)	Maine	Yes	No	Yes	No
	Ouvane	No	No	Yes	No
Killarney National Park, Macgillycuddy'S Reeks And Caragh River Catchment SAC (000365)	Maine	Yes	Yes	Yes	No
	Ouvane	No	Yes	Yes	No
Killyconny Bog (Cloghbally) SAC (000006)	Boyne	No	No	No	Yes

Natura 2000 sites	Relevant scheme	Natura 2000 Sites within 15km radius of OPW Scheme	FWPM is a QI of this Natura 2000 site	FWPM sensitive area within 3kms upstream or 35kms downstream of scheme	GWDTE a QI of Natura 2000 site
Kilmuckridge-Tinnaberna Sandhills SAC (001741)	Owenavorrach	No	No	No	No
Kilroosky Lough Cluster SAC (001786)	Abbey	No	No	No	Yes
	Duff	No	No	No	Yes
	Kilcoo	No	No	No	Yes
Kiltartan Cave (Coole) SAC (000286)	Gort	Yes	No	No	No
	Lacken	Yes	No	No	No
Kiltiernan Turlough SAC (001285)	Gort	Yes	No	No	No
	Lacken	Yes	No	No	No
Knockacoller Bog SAC (002333)	Kilkenny	No	No	No	Yes
Knockalongy And Knockachree Cliffs SAC (001669)	Bonet	No	No	No	No
Knockanira House SAC (002318)	Shannon embankments North	No	No	No	No
	Sixmilebridge	No	No	No	No
Lackan Saltmarsh And Kilcummin Head SAC (000516)	Moy	Yes	No	Yes	No
Lady'S Island Lake SAC (000704)	Ballyteigue Kilmore Embankment and Drainage Scheme	Yes	No	No	No
Lady's Island Lake SPA (004009)	Ballyteigue Kilmore Embankment and Drainage Scheme	Yes	No	No	Yes
Leannan River SAC (002176)	Donegal Swilly embankments, Blanket Nook, Bridge End FRS and Skeoge & Burnfoot embankment schemes	Yes	Yes	No	No
Levally Lough SAC (000295)	Corrib	Yes	No	No	No
Lisbigney Bog SAC (000869)	Kilkenny	No	No	No	Yes

Natura 2000 sites	Relevant scheme	Natura 2000 Sites within 15km radius of OPW Scheme	FWPM is a QI of this Natura 2000 site	FWPM sensitive area within 3kms upstream or 35kms downstream of scheme	GWDTE a QI of Natura 2000 site
Liskeenan Fen SAC (001683)	Carrigahorig	Yes	No	No	No
	Clareen	No	No	No	No
	Killimor	No	No	No	No
	Nenagh	No	No	No	No
	Woodford	No	No	Yes	No
Lisnageeragh Bog And Ballinastack Turlough SAC (000296)	Corrib	Yes	No	No	Yes
Loop Head SPA (004119)	Shannon embankments North	No	No	No	No
	Sixmilebridge	No	No	No	No
Lough Arrow SAC (001673)	Bonet	Yes	No	No	No
Lough Arrow SPA (004050)	Bonet	Yes	No	No	Yes
Lough Bane And Lough Glass SAC (002120)	Boyne	No	No	No	No
Lough Carra SPA (004051)	Corrib	Yes	No	No	No
Lough Carra/Mask Complex SAC (001774)	Corrib	Yes	No	No	Yes
Lough Conn and Lough Cullin SPA (004228)	Moy	Yes	No	Yes	Yes
Lough Corrib SAC (000297)	Corrib	Yes	Yes	No	Yes
Lough Corrib SPA (004042)	Corrib	Yes	No	No	Yes
Lough Coy SAC (002117)	Gort	Yes	No	No	No
	Lacken	Yes	No	No	No
Lough Cutra SAC (000299)	Gort	Yes	No	No	No
	Lacken	Yes	No	No	No
	Shannon embankments North	No	No	No	No
	Sixmilebridge	No	No	No	No

Natura 2000 sites	Relevant scheme	Natura 2000 Sites within 15km radius of OPW Scheme	FWPM is a QI of this Natura 2000 site	FWPM sensitive area within 3kms upstream or 35kms downstream of scheme	GWDTE a QI of Natura 2000 site
Lough Cutra SPA (004056)	Gort	Yes	No	No	No
	Lacken	Yes	No	No	No
Lough Derg (Donegal) SPA (004057)	Donegal - Cloonburn Arterial Drainage Scheme and Deel & Swillyburn Estuarine Embankment scheme	No	No	No	No
Lough Derg (Shannon) SPA (004058)	Carrigahorig	Yes	No	No	Yes
	Clareen	Yes	No	No	Yes
	Killimor	Yes	No	No	Yes
	Nenagh	Yes	No	No	Yes
	Woodford	Yes	No	Yes	Yes
Lough Derg, North-East Shore SAC (002241)	Carrigahorig	Yes	No	No	Yes
	Clareen	Yes	No	No	Yes
	Killimor	Yes	No	No	Yes
	Nenagh	Yes	No	No	Yes
	Woodford	Yes	No	Yes	Yes
Lough Derravaragh SPA (004043)	Inny - Upper Shannon (E and F) Catchments	Yes	No	No	Yes
Lough Ennell SAC (000685)	Brosna Arterial Drainage and Embankment Scheme	Yes	No	No	Yes
Lough Ennell SPA (004044)	Brosna Arterial Drainage and Embankment Scheme	Yes	No	No	Yes
Lough Fern SPA (004060)	Donegal Swilly embankments, Blanket Nook, Bridge End FRS and Skeoge & Burnfoot embankment schemes	Yes	No	No	Yes

Natura 2000 sites	Relevant scheme	Natura 2000 Sites within 15km radius of OPW Scheme	FWPM is a QI of this Natura 2000 site	FWPM sensitive area within 3kms upstream or 35kms downstream of scheme	GWDTE a QI of Natura 2000 site
Lough Fingall Complex SAC (000606)	Gort	Yes	No	No	No
	Lacken	Yes	No	No	No
Lough Gara SPA (004048)	Boyle	Yes	No	No	No
Lough Gash Turlough SAC (000051)	Shannon embankments North	Yes	No	No	Yes
	Sixmilebridge	Yes	No	No	Yes
Lough Gill SAC (001976)	Bonet	Yes	No	No	No
Lough Golagh And Breesy Hill SAC (002164)	Abbey	Yes	No	No	No
	Duff	Yes	No	No	No
	Kilcoo	No	No	No	No
Lough Hoe Bog SAC (000633)	Moy	Yes	No	Yes	Yes
Lough Hyne Nature Reserve And Environs SAC (000097)	Bandon River (Dunmanway)	No	No	Yes	No
Lough Iron SPA (004046)	Inny - Upper Shannon (E and F) Catchments	Yes	No	No	Yes
Lough Kinale and Derragh Lough SPA (004061)	Inny - Upper Shannon (E and F) Catchments	Yes	No	No	Yes
Lough Lene SAC (002121)	Boyne	No	No	No	No
Lough Lurleen Bog/Glenamaddy Turlough SAC (000301)	Corrib	Yes	No	No	Yes
Lough Mask SAC (004062)	Corrib	Yes	No	No	No
Lough Mask SPA (004062)	Corrib	Yes	No	No	Yes
Lough Melvin SAC (000428)	Abbey	Yes	No	No	No
	Duff	No	No	No	No
	Kilcoo	Yes	No	No	No
Lough Nabrickkeagh Bog SAC (000634)	Moy	No	No	Yes	No

Natura 2000 sites	Relevant scheme	Natura 2000 Sites within 15km radius of OPW Scheme	FWPM is a QI of this Natura 2000 site	FWPM sensitive area within 3kms upstream or 35kms downstream of scheme	GWDTE a QI of Natura 2000 site
Lough Nageage SAC (002135)	Abbey	No	No	No	No
	Duff	No	No	No	No
	Kilcoo	No	No	No	No
Lough Oughter And Associated Loughs SAC (000007)	Abbey	No	No	No	Yes
	Duff	No	No	No	Yes
	Kilcoo	No	No	No	Yes
Lough Oughter Complex SPA (004049)	Abbey	No	No	No	Yes
	Duff	No	No	No	Yes
	Kilcoo	No	No	No	Yes
Lough Owel SAC (000688)	Brosna Arterial Drainage and Embankment Scheme	No	No	No	Yes
Lough Owel SPA (004047)	Brosna Arterial Drainage and Embankment Scheme	No	No	No	Yes
Lough Rea SAC (000304)	Gort	No	No	No	No
	Lacken	Yes	No	No	No
Lough Rea SPA (004134)	Gort	No	No	No	Yes
	Lacken	Yes	No	No	Yes
Lough Ree SAC (000440)	Ballyglass (Knockcrohery) Scheme	Yes	No	No	Yes
	Inny - Upper Shannon (E and F) Catchments	Yes	No	No	Yes
Lough Ree SPA (004064)	Ballyglass (Knockcrohery) Scheme	Yes	No	No	Yes
	Inny - Upper Shannon (E and F) Catchments	Yes	No	No	Yes

Natura 2000 sites	Relevant scheme	Natura 2000 Sites within 15km radius of OPW Scheme	FWPM is a QI of this Natura 2000 site	FWPM sensitive area within 3kms upstream or 35kms downstream of scheme	GWDTE a QI of Natura 2000 site
Lough Sheelin SPA (004065)	Inny - Upper Shannon (E and F) Catchments	Yes	No	No	Yes
Lough Swilly SAC (002287)	Donegal Swilly embankments, Blanket Nook, Bridge End FRS and Skeoge & Burnfoot embankment schemes	Yes	No	No	No
Lough Swilly SPA (004075)	Donegal Swilly embankments, Blanket Nook, Bridge End FRS and Skeoge & Burnfoot embankment schemes	Yes	No	No	Yes
Lough Yganavan And Lough Nambrackdarrig SAC (000370)	Maine	Yes	No	Yes	No
Loughatorick South Bog SAC (000308)	Carrigahorig	No	No	No	No
	Clareen	Yes	No	No	No
	Killimor	Yes	No	No	No
	Nenagh	Yes	No	No	No
	Woodford	Yes	No	Yes	No
Lower River Shannon SAC (002165)	Carrigahorig	No	Yes	No	No
	Clareen	Yes	Yes	No	No
	Deel	Yes	Yes	No	No
	Feale	Yes	Yes	Yes	No
	Groody	Yes	Yes	No	No
	Killimor	No	Yes	No	No
	Maigue	Yes	Yes	No	No
	Maigue Outfall	Yes	Yes	No	No

Natura 2000 sites	Relevant scheme	Natura 2000 Sites within 15km radius of OPW Scheme	FWPM is a QI of this Natura 2000 site	FWPM sensitive area within 3kms upstream or 35kms downstream of scheme	GWDTE a QI of Natura 2000 site
	Mulkear Ballymackeogh	Yes	Yes	No	No
	Mulkear Cappamore	Yes	Yes	No	No
	Nenagh	Yes	Yes	No	No
	Shannon embankments North	Yes	Yes	No	No
	Shannon Embankments South	Yes	Yes	No	No
	Sixmilebridge	Yes	Yes	No	No
	Woodford	No	Yes	Yes	No
Lower River Suir SAC (002137)	Carrick-on-suir	Yes	Yes	Yes	Yes
	Groody	No	Yes	No	Yes
	Kilkenny	No	Yes	No	Yes
	Mulkear Ballymackeogh	No	Yes	No	Yes
Magharee Islands SPA (004125)	Feale	No	No	Yes	No
Malahide Estuary SAC (000205)	Broad Meadow and Ward	Yes	No	No	No
	Duleek	No	No	No	No
	Hazelhatch (Sinkeen) Scheme	No	No	No	No
	Matt	Yes	No	No	No
	Ryewater	No	No	No	No
Malahide Estuary SPA (004025)	Broad Meadow and Ward	Yes	No	No	Yes
	Duleek	No	No	No	Yes
	Hazelhatch (Sinkeen) Scheme	No	No	No	Yes
	Matt	Yes	No	No	Yes
	Ryewater	No	No	No	Yes
Maulagowna Bog SAC (001881)	Ouvane	No	No	Yes	No

Natura 2000 sites	Relevant scheme	Natura 2000 Sites within 15km radius of OPW Scheme	FWPM is a QI of this Natura 2000 site	FWPM sensitive area within 3kms upstream or 35kms downstream of scheme	GWDTE a QI of Natura 2000 site
Maumturk Mountains SAC (002008)	Corrib	No	No	No	No
Meenaguse Scragh SAC (001880)	Donegal - Cloonburn Arterial Drainage Scheme and Deel & Swillyburn Estuarine Embankment scheme	No	No	No	No
Meentygrannagh Bog SAC (000173)	Donegal - Cloonburn Arterial Drainage Scheme and Deel & Swillyburn Estuarine Embankment scheme	No	No	No	Yes
	Donegal Swilly embankments, Blanket Nook, Bridge End FRS and Skeoge & Burnfoot embankment schemes	Yes	No	No	Yes
Mid-Clare Coast SPA (004182)	Cloghauinchy	Yes	No	No	Yes
	Creegh	Yes	No	No	Yes
Middle Shannon Callows SPA (004096)	Brosna Arterial Drainage and Embankment Scheme	No	No	No	Yes
	Carrigahorig	Yes	No	No	Yes
	Clareen	No	No	No	Yes
	Killimor	Yes	No	No	Yes
	Nenagh	No	No	No	Yes
	Woodford	Yes	No	Yes	Yes
Mid-Waterford Coast SPA (004193)	Brickey	Yes	No	No	No
Moanour Mountain SAC (002257)	Carrick-on-suir	No	No	Yes	No
Moanveanlagh Bog SAC (002351)	Feale	Yes	No	Yes	Yes
Mocorha Lough SAC (001536)	Corrib	Yes	No	No	No

Natura 2000 sites	Relevant scheme	Natura 2000 Sites within 15km radius of OPW Scheme	FWPM is a QI of this Natura 2000 site	FWPM sensitive area within 3kms upstream or 35kms downstream of scheme	GWDTE a QI of Natura 2000 site
Moneen Mountain SAC (000054)	Gort	No	No	No	Yes
	Lacken	No	No	No	Yes
	Shannon embankments North	No	No	No	Yes
	Sixmilebridge	No	No	No	Yes
Moneybeg And Clareisland Bogs SAC (002340)	Inny - Upper Shannon (E and F) Catchments	Yes	No	No	Yes
Monivea Bog SAC (002352)	Corrib	Yes	No	No	Yes
	Gort	No	No	No	Yes
	Lacken	No	No	No	Yes
Moore Hall (Lough Carra) SAC (000527)	Corrib	Yes	No	No	No
Mouds Bog SAC (002331)	Hazelhatch (Sinkeen) Scheme	No	No	No	Yes
	Ryewater	No	No	No	Yes
Mount Brandon SAC (000375)	Feale	No	Yes	Yes	No
	Maine	No	Yes	Yes	No
Mount Hevey Bog SAC (002342)	Boyne	No	No	No	Yes
Moyree River System SAC (000057)	Shannon embankments North	No	No	No	Yes
	Sixmilebridge	No	No	No	Yes
Mucksna Wood SAC (001371)	Ouvane	No	No	Yes	No
Mullaghanish Bog SAC (001890)	Maine	No	No	Yes	No
Mweelrea/Sheeffry/Erriff Complex SAC (001932)	Corrib	No	Yes	No	Yes
Myross Wood SAC (001070)	Bandon River (Dunmanway)	No	No	Yes	No
Newgrove House SAC (002157)	Shannon embankments North	No	No	No	No
	Sixmilebridge	Yes	No	No	No

Natura 2000 sites	Relevant scheme	Natura 2000 Sites within 15km radius of OPW Scheme	FWPM is a QI of this Natura 2000 site	FWPM sensitive area within 3kms upstream or 35kms downstream of scheme	GWDTE a QI of Natura 2000 site
Newhall And Edenvale Complex SAC (002091)	Shannon embankments North	No	No	No	No
	Sixmilebridge	No	No	No	No
Nier Valley Woodlands SAC (000668)	Carrick-on-suir	Yes	No	Yes	No
North Bull Island SPA (004006)	Hazelhatch (Sinkeen) Scheme	No	No	No	Yes
	Ryewater	No	No	No	Yes
North Dublin Bay SAC (000206)	Hazelhatch (Sinkeen) Scheme	No	No	No	Yes
	Ryewater	No	No	No	Yes
North Inishowen Coast SAC (002012)	Donegal Swilly embankments, Blanket Nook, Bridge End FRS and Skeoge & Burnfoot embankment schemes	No	No	No	Yes
Old Domestic Building (Keevagh) SAC (002010)	Shannon embankments North	No	No	No	No
	Sixmilebridge	Yes	No	No	No
Old Domestic Building, Askive Wood SAC (002098)	Ouvane	No	No	Yes	No
Old Domestic Building, Curraglass Wood SAC (002041)	Maine	No	No	Yes	No
Old Domestic Building, Dromore Wood SAC (000353)	Ouvane	No	No	Yes	No
Old Domestic Buildings, Rylane SAC (002314)	Shannon embankments North	No	No	No	No
	Sixmilebridge	No	No	No	No
Old Farm Buildings, Ballymacrogan SAC (002245)	Shannon embankments North	No	No	No	No
	Sixmilebridge	No	No	No	No
Old Head of Kinsale SPA (004021)	Bandon River (Dunmanway)	No	No	Yes	No
Owenduff/Nephin Complex SAC (000534)	Moy	No	No	Yes	Yes
Ox Mountains Bogs SAC (002006)	Bonet	No	No	No	Yes
	Moy	Yes	No	Yes	Yes

Natura 2000 sites	Relevant scheme	Natura 2000 Sites within 15km radius of OPW Scheme	FWPM is a QI of this Natura 2000 site	FWPM sensitive area within 3kms upstream or 35kms downstream of scheme	GWDTE a QI of Natura 2000 site
Peterswell Turlough SAC (000318)	Gort	Yes	No	No	Yes
	Lacken	Yes	No	No	Yes
Pettigo Plateau Nature Reserve SAC (004099)	Donegal - Cloonburn Arterial Drainage Scheme and Deel & Swillyburn Estuarine Embankment scheme	No	No	No	No
Philipston Marsh SAC (001847)	Groody	No	No	No	Yes
	Mulkear Ballymackeogh	No	No	No	Yes
	Mulkear Cappamore	Yes	No	No	Yes
Pollagoona Bog SAC (002126)	Carrigahorig	No	No	No	No
	Clareen	No	No	No	No
	Killimor	Yes	No	No	No
	Nenagh	No	No	No	No
	Woodford	Yes	No	Yes	No
Pollnaknockaun Wood Nature Reserve SAC (000319)	Carrigahorig	No	No	No	No
	Clareen	No	No	No	No
	Killimor	Yes	No	No	No
	Nenagh	No	No	No	No
	Woodford	Yes	No	Yes	No
Pouladatig Cave SAC (000037)	Shannon embankments North	No	No	No	No
	Sixmilebridge	No	No	No	No
Poulaphouca Reservoir SPA (004063)	Hazelhatch (Sinkeen) Scheme	No	No	No	No
	Ryewater	No	No	No	No
Poulmagordon Cave (Quin) SAC (000064)	Shannon embankments North	Yes	No	No	No

Natura 2000 sites	Relevant scheme	Natura 2000 Sites within 15km radius of OPW Scheme	FWPM is a QI of this Natura 2000 site	FWPM sensitive area within 3kms upstream or 35kms downstream of scheme	GWDTE a QI of Natura 2000 site
	Sixmilebridge	Yes	No	No	No
Puffin Island SPA (004003)	Ouvane	No	No	Yes	No
Rahasane Turlough SAC (000322)	Gort	No	No	No	No
	Lacken	Yes	No	No	No
Rahasane Turlough SPA (004089)	Gort	No	No	No	Yes
	Lacken	Yes	No	No	Yes
Raheenmore Bog SAC (000582)	Boyne	No	No	No	Yes
	Brosna Arterial Drainage and Embankment Scheme	Yes	No	No	Yes
Ratty River Cave SAC (002316)	Shannon embankments North	Yes	No	No	No
	Sixmilebridge	Yes	No	No	No
Raven Point Nature Reserve SAC (000710)	Owenavorrigh	No	No	No	Yes
Red Bog, Kildare SAC (000397)	Hazelhatch (Sinkeen) Scheme	Yes	No	No	Yes
	Ryewater	No	No	No	Yes
Reen Point Shingle SAC (002281)	Ouvane	No	No	Yes	No
River Barrow And River Nore SAC (002162)	Ballyteigue Kilmore Embankment and Drainage Scheme	No	Yes	No	Yes
	Brickey	No	Yes	No	Yes
	Carrick-on-suir	No	Yes	Yes	Yes
	Kilkenny	Yes	Yes	No	Yes
River Boyne And River Blackwater SAC (002299)	Boyne	Yes	No	No	Yes
River Boyne and River Blackwater SPA (004232)	Boyne	Yes	No	No	No
River Finn SAC (002301)	Donegal - Cloonburn Arterial	Yes	No	No	Yes

Natura 2000 sites	Relevant scheme	Natura 2000 Sites within 15km radius of OPW Scheme	FWPM is a QI of this Natura 2000 site	FWPM sensitive area within 3kms upstream or 35kms downstream of scheme	GWDTE a QI of Natura 2000 site
	Drainage Scheme and Deel & Swillyburn Estuarine Embankment scheme				
River Moy SAC (002298)	Moy	Yes	No	Yes	Yes
River Nanny Estuary And Shore SPA (004158)	Duleek	Yes	No	No	Yes
	Matt	Yes	No	No	Yes
River Nore SPA (004233)	Kilkenny	Yes	No	No	No
River Shannon and River Fergus Estuaries SPA (004077)	Deel	Yes	No	No	Yes
	Groody	Yes	No	No	Yes
	Maigue	Yes	No	No	Yes
	Maigue Outfall	Yes	No	No	Yes
	Mulkear Ballymackeogh	Yes	No	No	Yes
	Mulkear Cappamore	No	No	No	Yes
	Shannon embankments North	Yes	No	No	Yes
	Shannon Embankments South	Yes	No	No	Yes
	Sixmilebridge	Yes	No	No	Yes
River Shannon Callows SAC (000216)	Brosna Arterial Drainage and Embankment Scheme	No	No	No	No
	Carrigahorig	Yes	No	No	No
	Clareen	No	No	No	No
	Killimor	Yes	No	No	No
	Nenagh	No	No	No	No
	Woodford	Yes	No	Yes	No
Roaringwater Bay And Islands SAC (000101)	Bandon River (Dunmanway)	No	No	Yes	No

Natura 2000 sites	Relevant scheme	Natura 2000 Sites within 15km radius of OPW Scheme	FWPM is a QI of this Natura 2000 site	FWPM sensitive area within 3kms upstream or 35kms downstream of scheme	GWDTE a QI of Natura 2000 site
Rockabill to Dalkey Island SAC SAC (003000)	Hazelhatch (Sinkeen) Scheme	No	No	No	No
	Ryewater	No	No	No	No
Rogerstown Estuary SAC (000208)	Broad Meadow and Ward	Yes	No	No	No
	Duleek	No	No	No	No
	Matt	Yes	No	No	No
Rogerstown Estuary SPA (004015)	Broad Meadow and Ward	Yes	No	No	Yes
	Duleek	No	No	No	Yes
	Matt	Yes	No	No	Yes
Ross Lake And Woods SAC (001312)	Corrib	Yes	No	No	No
Rosturra Wood SAC (001313)	Carrigahorig	Yes	No	No	No
	Clareen	No	No	No	No
	Killimor	Yes	No	No	No
	Nenagh	No	No	No	No
	Woodford	Yes	No	Yes	No
Rye Water Valley/Carlton SAC (001398)	Hazelhatch (Sinkeen) Scheme	Yes	No	No	Yes
	Ryewater	Yes	No	No	Yes
Scragh Bog SAC (000692)	Brosna Arterial Drainage and Embankment Scheme	No	No	No	Yes
Screen Hills SAC (000708)	Owenavorrigh	No	No	No	No
Seven Heads SPA (004191)	Bandon River (Dunmanway)	No	No	Yes	No
Sheep'S Head SAC (000102)	Ouvane	No	No	Yes	No
Sheeps Head to Toe Head SPA (004156)	Bandon River (Dunmanway)	No	No	Yes	No
	Ouvane	No	No	Yes	No

Natura 2000 sites	Relevant scheme	Natura 2000 Sites within 15km radius of OPW Scheme	FWPM is a QI of this Natura 2000 site	FWPM sensitive area within 3kms upstream or 35kms downstream of scheme	GWDTE a QI of Natura 2000 site
Sheheree (Ardagh) Bog SAC (000382)	Maine	No	No	Yes	Yes
Shrule Turlough SAC (000525)	Corrib	Yes	No	No	No
Silvermine Mountains SAC (000939)	Groody	No	No	No	No
	Mulkear Ballymackeogh	No	No	No	No
	Mulkear Cappamore	No	No	No	No
Silvermines Mountains West SAC (002258)	Groody	No	No	No	No
	Mulkear Ballymackeogh	No	No	No	No
	Mulkear Cappamore	No	No	No	No
Skealaghan Turlough SAC (000541)	Corrib	Yes	No	No	No
Slieve Aughty Mountains SPA (004168)	Carrigahorig	Yes	No	No	No
	Clareen	Yes	No	No	No
	Gort	Yes	No	No	No
	Killimor	Yes	No	No	No
	Lacken	Yes	No	No	No
	Nenagh	Yes	No	No	No
	Shannon embankments North	No	No	No	No
	Sixmilebridge	No	No	No	No
	Woodford	Yes	No	Yes	No
Slieve Beagh SPA (004167)	Abbey	No	No	No	No
	Duff	No	No	No	No
	Kilcoo	Yes	No	No	No
	Monaghan B	No	No	No	No
Slieve Bernagh Bog SAC (002312)	Carrigahorig	No	No	No	No

Natura 2000 sites	Relevant scheme	Natura 2000 Sites within 15km radius of OPW Scheme	FWPM is a QI of this Natura 2000 site	FWPM sensitive area within 3kms upstream or 35kms downstream of scheme	GWDTE a QI of Natura 2000 site
	Clareen	Yes	No	No	No
	Groody	No	No	No	No
	Killimor	No	No	No	No
	Mulkear Ballymackeogh	No	No	No	No
	Mulkear Cappamore	No	No	No	No
	Nenagh	No	No	No	No
	Shannon embankments North	No	No	No	No
	Sixmilebridge	No	No	No	No
	Woodford	No	No	Yes	No
Slieve Bloom Mountains SAC (000412)	Brosna Arterial Drainage and Embankment Scheme	Yes	No	No	No
	Kilkenny	No	No	No	No
Slieve Bloom Mountains SPA (004160)	Brosna Arterial Drainage and Embankment Scheme	Yes	No	No	No
	Kilkenny	No	No	No	No
Slieve Mish Mountains SAC (002185)	Feale	Yes	No	Yes	No
	Maine	Yes	No	Yes	No
Slievefelim to Silvermines Mountains SPA (004165)	Carrick-on-suir	No	No	Yes	No
	Carrigahorig	No	No	No	No
	Clareen	Yes	No	No	No
	Groody	Yes	No	No	No
	Killimor	No	No	No	No
	Mulkear Ballymackeogh	Yes	No	No	No

Natura 2000 sites	Relevant scheme	Natura 2000 Sites within 15km radius of OPW Scheme	FWPM is a QI of this Natura 2000 site	FWPM sensitive area within 3kms upstream or 35kms downstream of scheme	GWDTE a QI of Natura 2000 site
	Mulkear Cappamore	Yes	No	No	No
	Nenagh	Yes	No	No	No
	Woodford	No	No	Yes	No
Sligo/Leitrim Uplands SPA (004187)	Abbey	No	No	No	No
	Bonet	Yes	No	No	No
	Duff	Yes	No	No	No
	Kilcoo	Yes	No	No	No
Sonnagh Bog SAC (001913)	Gort	Yes	No	No	No
	Killimor	Yes	No	No	No
	Lacken	Yes	No	No	No
South Dublin Bay amd River Tolka Estuary SPA (004024)	Hazelhatch (Sinkeen) Scheme	No	No	No	Yes
	Ryewater	No	No	No	Yes
South Dublin Bay SAC (000210)	Hazelhatch (Sinkeen) Scheme	No	No	No	No
	Ryewater	No	No	No	No
Spahill And Clomantagh Hill SAC (000849)	Kilkenny	No	No	No	No
Split Hills And Long Hill Esker SAC (001831)	Brosna Arterial Drainage and Embankment Scheme	Yes	No	No	No
Stabannan-Braganstown SPA (004091)	Glyde and Dee	Yes	No	No	No
Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (004161)	Deel	Yes	No	No	No
	Feale	Yes	No	Yes	No
	Maigue	Yes	No	No	No
	Maigue Outfall	No	No	No	No
	Maine	Yes	No	Yes	No

Natura 2000 sites	Relevant scheme	Natura 2000 Sites within 15km radius of OPW Scheme	FWPM is a QI of this Natura 2000 site	FWPM sensitive area within 3kms upstream or 35kms downstream of scheme	GWDTE a QI of Natura 2000 site
	Shannon Embankments South	Yes	No	No	No
Streedagh Point Dunes SAC (001680)	Bonet	No	No	No	Yes
Tacumshin Lake SAC (000709)	Ballyteigue Kilmore Embankment and Drainage Scheme	Yes	No	No	No
Tacumshin Lake SPA (004092)	Ballyteigue Kilmore Embankment and Drainage Scheme	Yes	No	No	Yes
Tamur Bog SAC (001992)	Abbey	Yes	No	No	No
	Duff	No	No	No	No
	Kilcoo	No	No	No	No
Templehouse And Cloonacleigha Loughs SAC (000636)	Bonet	Yes	No	No	No
Termon Lough SAC (001321)	Gort	Yes	No	No	No
	Lacken	Yes	No	No	No
The Loughans SAC (000407)	Kilkenny	No	No	No	No
The Raven SPA (004019)	Owenavorrach	No	No	No	Yes
Thomastown Quarry SAC (002252)	Kilkenny	Yes	No	No	Yes
Three Castle Head To Mizen Head SAC (000109)	Ouvane	No	No	Yes	No
Toonagh Estate SAC (002247)	Shannon embankments North	No	No	No	No
	Sixmilebridge	No	No	No	No
Tory Hill SAC (000439)	Deel	Yes	No	No	Yes
	Maigue	Yes	No	No	Yes
	Maigue Outfall	Yes	No	No	Yes
Towerhill House SAC (002179)	Corrib	Yes	No	No	No

Natura 2000 sites	Relevant scheme	Natura 2000 Sites within 15km radius of OPW Scheme	FWPM is a QI of this Natura 2000 site	FWPM sensitive area within 3kms upstream or 35kms downstream of scheme	GWDTE a QI of Natura 2000 site
Tralee Bay And Magharees Peninsula, West To Cloghane SAC (002070)	Feale	Yes	No	Yes	Yes
Tralee Bay Complex SPA (004188)	Feale	Yes	No	Yes	Yes
Tramore Back Strand SPA (004027)	Brickey	No	No	No	Yes
Tramore Dunes And Backstrand SAC (000671)	Brickey	No	No	No	No
Tullaghanrock Bog SAC (002354)	Boyle	Yes	No	No	Yes
Tullaheer Lough And Bog SAC (002343)	Cloghauinchy	Yes	No	No	Yes
	Creegh	Yes	No	No	Yes
	Shannon embankments North	No	No	No	Yes
	Sixmilebridge	No	No	No	Yes
Turloughmore (Sligo) SAC (000637)	Bonet	No	No	No	No
Union Wood SAC (000638)	Bonet	Yes	No	No	No
Unshin River SAC (001898)	Bonet	Yes	No	No	No
Urlaur Lakes SAC (001571)	Boyle	Yes	No	No	No
Valencia Harbour/Portmagee Channel SAC (002262)	Maine	No	No	Yes	No
White Lough, Ben Loughs And Lough Doo SAC (001810)	Boyne	No	No	No	No
Wicklow Mountains SAC (002122)	Hazelhatch (Sinkeen) Scheme	Yes	No	No	No
	Ryewater	No	No	No	No
Wicklow Mountains SPA (004040)	Hazelhatch (Sinkeen) Scheme	No	No	No	No
	Ryewater	No	No	No	No
Williamstown Turloughs SAC (002296)	Corrib	Yes	No	No	No

C Assessment Table-Alternatives

Catchment: National Scale
Schemes: All

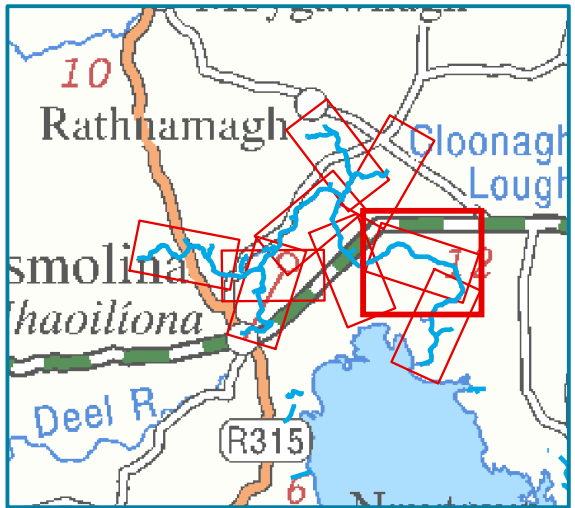
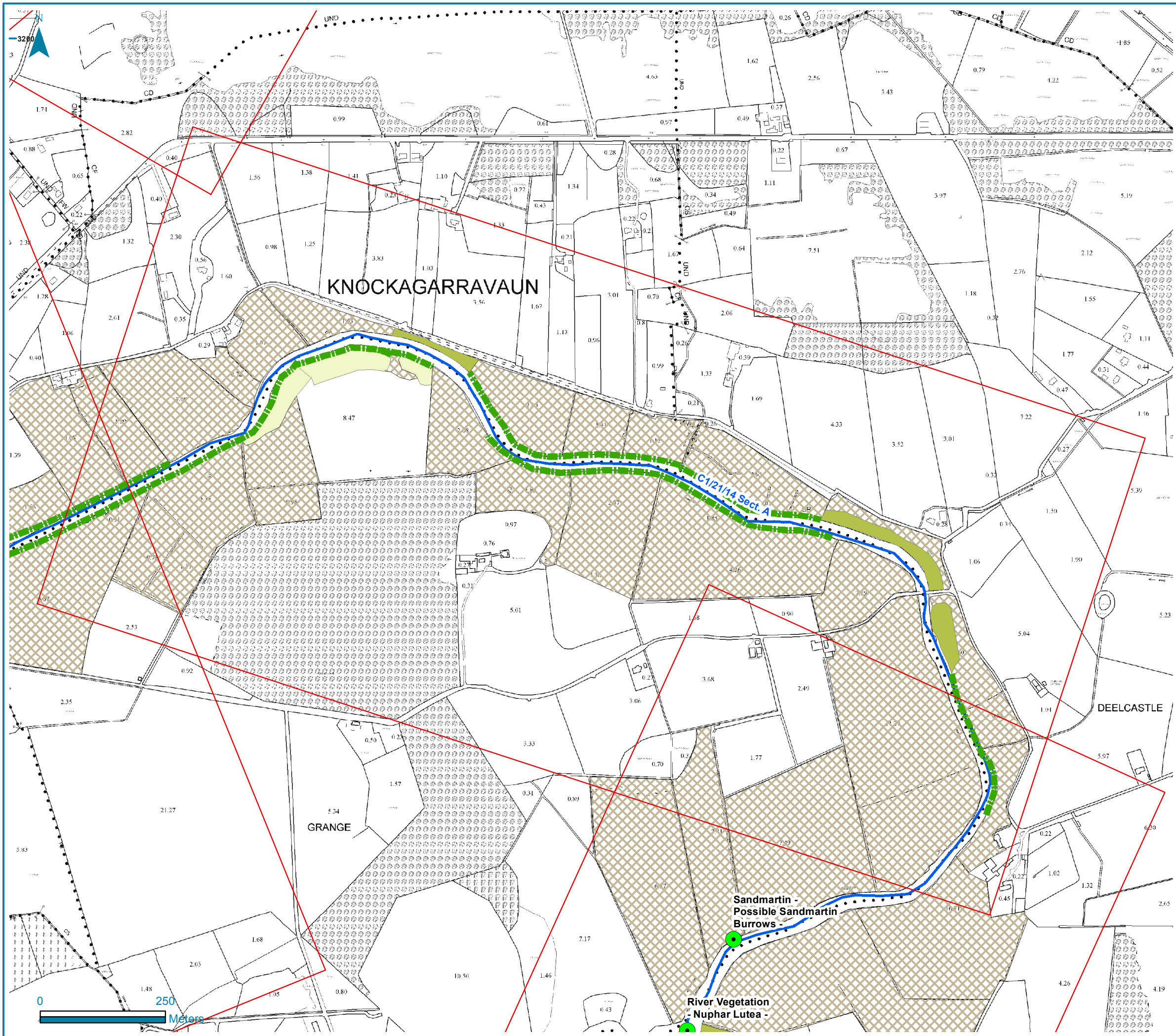
				Change in impact from existing (before recommended mitigation measures)			
				Do Minimum (reduction in funding by 50%)	Alternative 1 (an evolved approach to the current activities)	Alternative 2 (different methods to achieve the objectives of Arterial Drainage)	Alternative 3 (modification of arterial drainage)
Environmental (Water)	Support the objectives of the Water Framework Directive (WFD).	A1	Enhance natural fluvial processes in support of WFD objectives, through delivery of new, and maintenance of existing, EREP and other river restoration works that are part of the arterial drainage maintenance programme.	-	+	+	????
		A2	Provide no impediment to the achievement of water body objectives and contribute to the achievement of water body objectives.	-	+	+	????
		A3	Ensure water quality remains adequate to support a healthy aquatic biological community and that it meets environmental standards established for general physiochemical conditions and specific pollutants of concern.	-	+	+	????
Environmental (Flora, Fauna & Biodiversity)	Protect the flora and fauna within the river, river corridor and along vehicular access points and where possible enhance biodiversity.	B1	Support the objectives of the EU Habitats and Birds Directives by avoiding detrimental effects to, and where possible enhance, Natura 2000 network, protected species and habitats.	-	+	+	????
		B2	Avoid damage to, and where possible enhance, legally protected sites/habitats and species of national, regional and local conservation importance.	-	+	+	????
		B3	Protect existing riverine, wetland and peatland habitats to maintain naturally functioning ecosystems and hydromorphological conditions.	-	+	+	????
		B4	Protect, and where possible enhance, hedgerows and woodlands within the riparian corridor.	-	+	+	????
		B5	Minimise the risk of spread of any invasive aquatic or terrestrial species.	-	+	+	????
Environmental (Fisheries)	Protect and, where possible, enhance the integrity of fisheries within the Arterially Drained catchments.	C1	Maintain existing habitat supporting salmonid fisheries and carry out enhancement where possible.	-	+	+	????
		C2	Ensure no adverse effects on commercial shellfisheries.	-	+	+	????

				Change in impact from existing (before recommended mitigation measures)			
				Do Minimum (reduction in funding by 50%)	Alternative 1 (an evolved approach to the current activities)	Alternative 2 (different methods to achieve the objectives of Arterial Drainage)	Alternative 3 (modification of arterial drainage)
Environmental (Climate Change)	Minimise the climate change impacts of Arterial Drainage maintenance activities	D1	Reduce greenhouse gas emissions from machinery and equipment used in Arterial Drainage maintenance activity	-	+	+	+
		D2	Minimise release of sequestered greenhouse gases from sinks such as peatlands and forests.	-	+	+	+
	Adaptation to climate change	D3	Performance of arterial drainage scheme channels, embankments and flood relief schemes over time.	-	+	0	+
		D4	Adaptive capacity of ongoing maintenance activities to current and potential future demands.	-	+	0	+
Social	Public access and recreation	E1	Avoid negative impacts to existing water-based leisure activities.	-	+	0	+
	Contribute to viable and sustainable local communities	E2	Contribution to health and wellbeing of local communities including local employment	-	0	0	+
		E3	Maintain access to local services and transport networks up to the design standard of protection.	-	0	0	-
Economic	Avoid damage to, and where possible improve, the function and quality of the soil resource.	F1	Maintain soil quality and function for productivity on agricultural lands.	-	+	+	????
	Support agricultural activity without conflicting with environmental objectives.	F2	Maintain lands available for economic activity and no change as to render existing economic activity unviable.	-	0	0	-
Cultural Heritage	Protect known features of cultural heritage.	G1	Protect architectural buildings and structures listed on the Record of Protected Structures (RPS) and designated areas of architectural importance such as Architectural Conservation Areas (ACAs).	-	+	+	????
		G2	Protect archaeological features listed on the Record of Monuments and Places (RMP) or other listed National Monument and Archaeological Sites.	-	+	+	????
	Protection of unknown features of cultural heritage	G3	Protect undiscovered archaeological features.	-	+	+	????

Change in Impact

More positive impacts than proposed activities	+
No change	0
More negative impacts than proposed activities	-
Uncertain	????

D OPW Habitat Survey. Deel Scheme



Legend

Surveyed channels

Map Bounds

Point_Feature(otter_etc)

Linear Woodland / Scrub

WL2 Treelines

Woodland and Scrub

WD1 (Mixed) Broadleaved/Conifer Woodland

WS1 Scrub

Grassland and Marsh

GA1 Improved Agricultural Grassland

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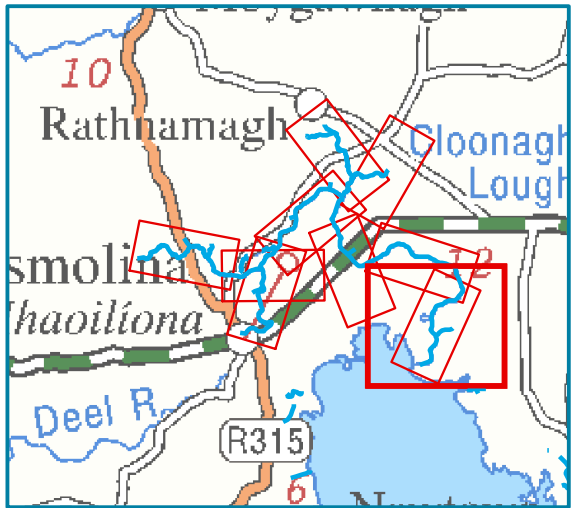
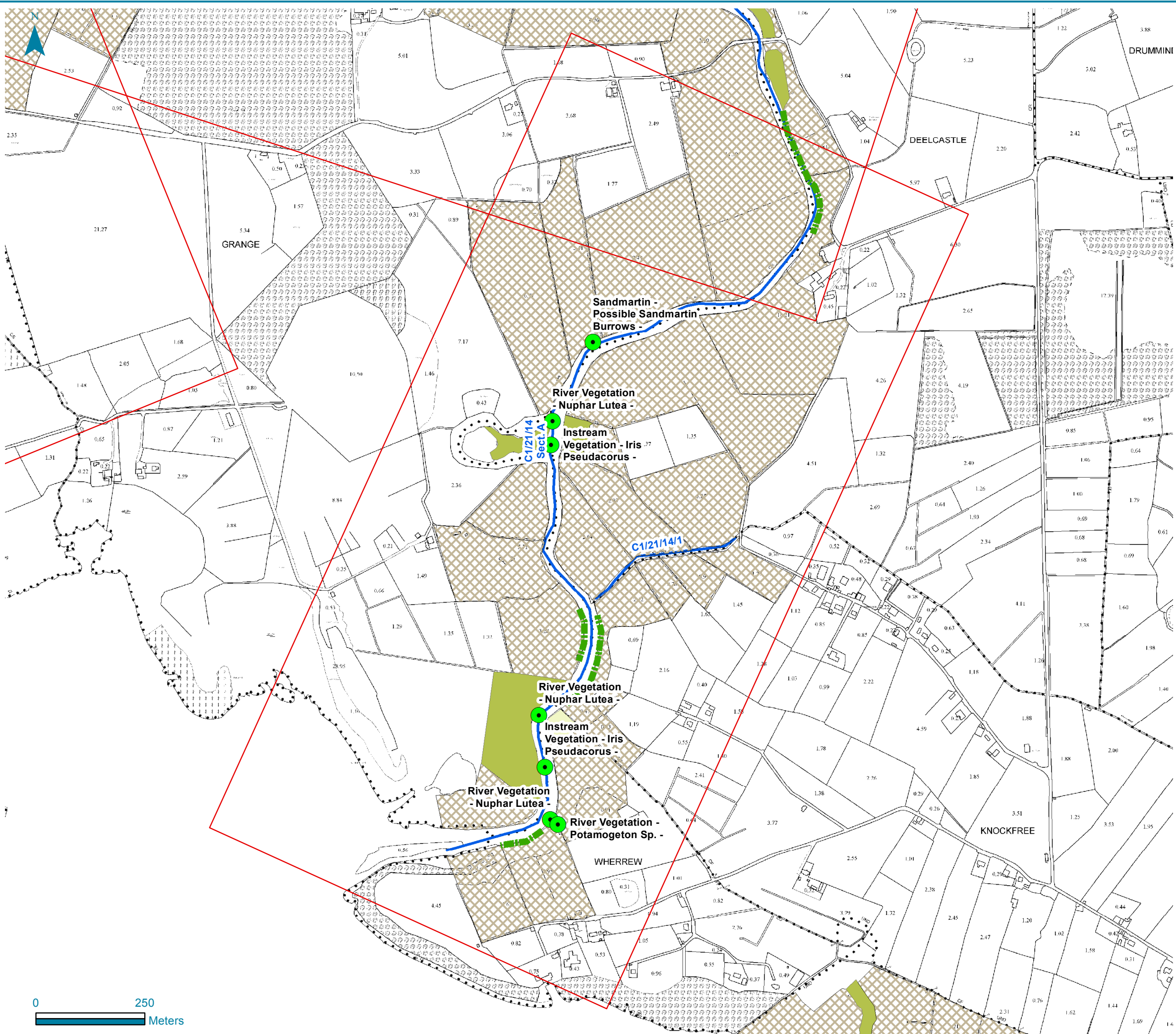
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Map No. 1

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Legend

- Surveyed channels
- Map Bounds
- Point_Feature(otter_etc)

Linear Woodland / Scrub

- WL2 Treelines

Woodland and Scrub

- WD1 (Mixed) Broadleaved/Conifer Woodland
- WS1 Scrub

Grassland and Marsh

- GA1 Improved Agricultural Grassland

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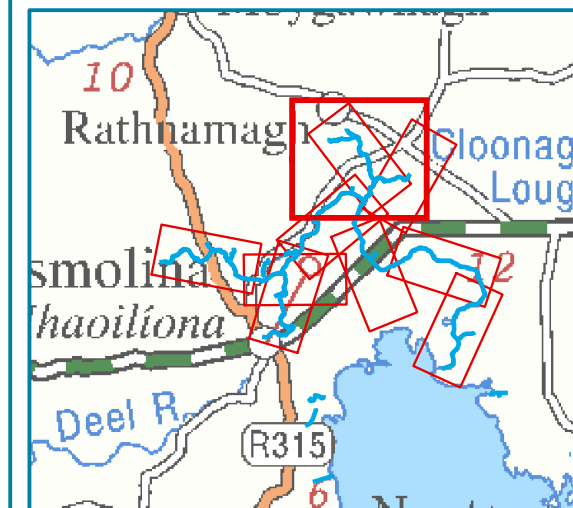
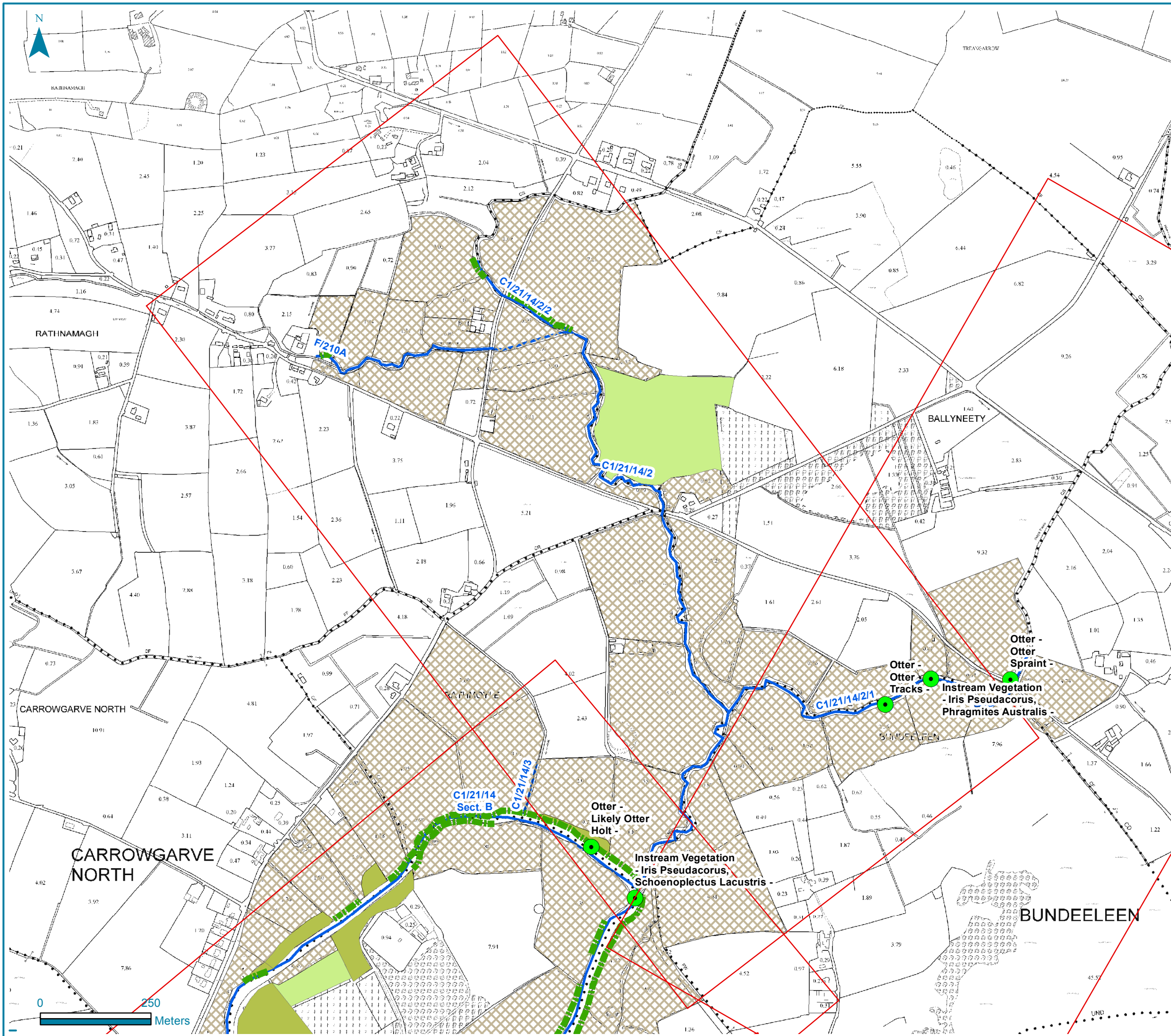
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Legend

- Surveyed channels
- Map Bounds
- Point_Feature(otter_etc)
- Linear Woodland / Scrub**
 - WL2 Treelines
- Woodland and Scrub**
 - WD1 (Mixed) Broadleaved/Conifer Woodland
 - WD4 Conifer Plantation
- Grassland and Marsh**
 - GA1 Improved Agricultural Grassland

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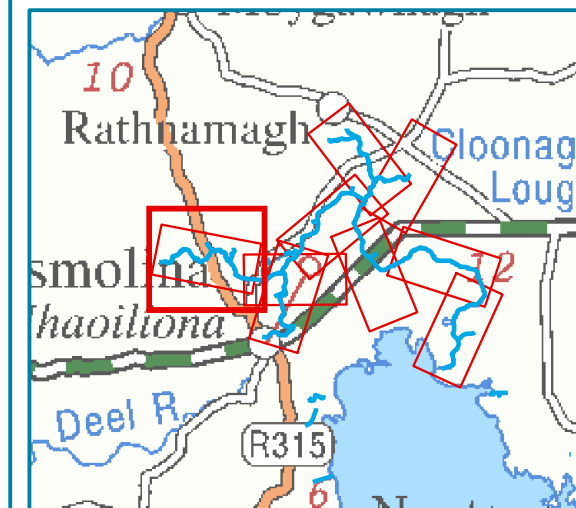
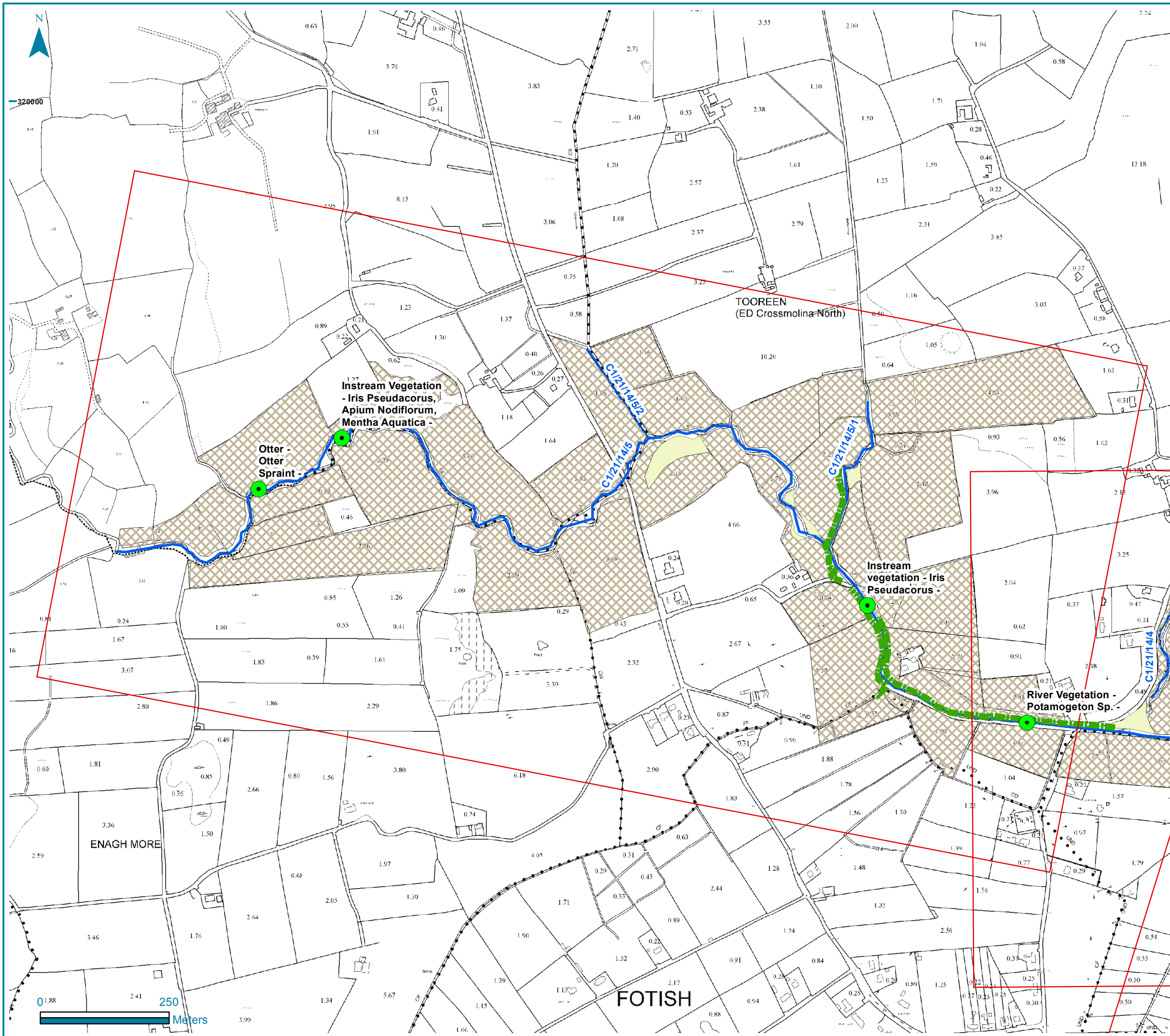
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- Legend**
- Surveys channels
 - Map Bounds
 - Point_Feature(otter_etc)
 - Linear Woodland / Scrub**
 - WL2 Treelines
 - Woodland and Scrub**
 - WS1 Scrub
 - Grassland and Marsh**
 - GA1 Improved Agricultural Grassland

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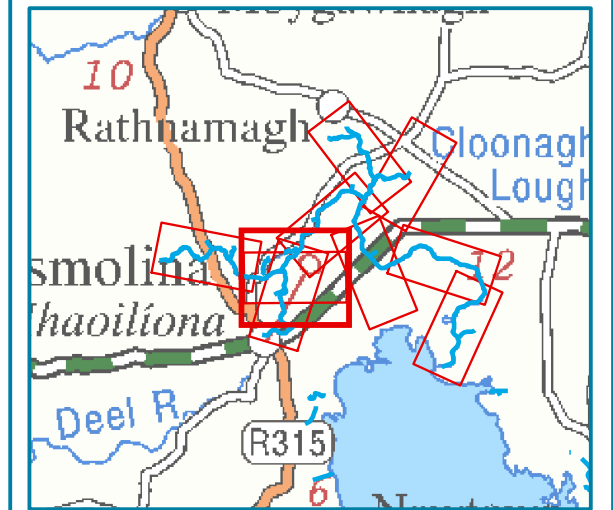
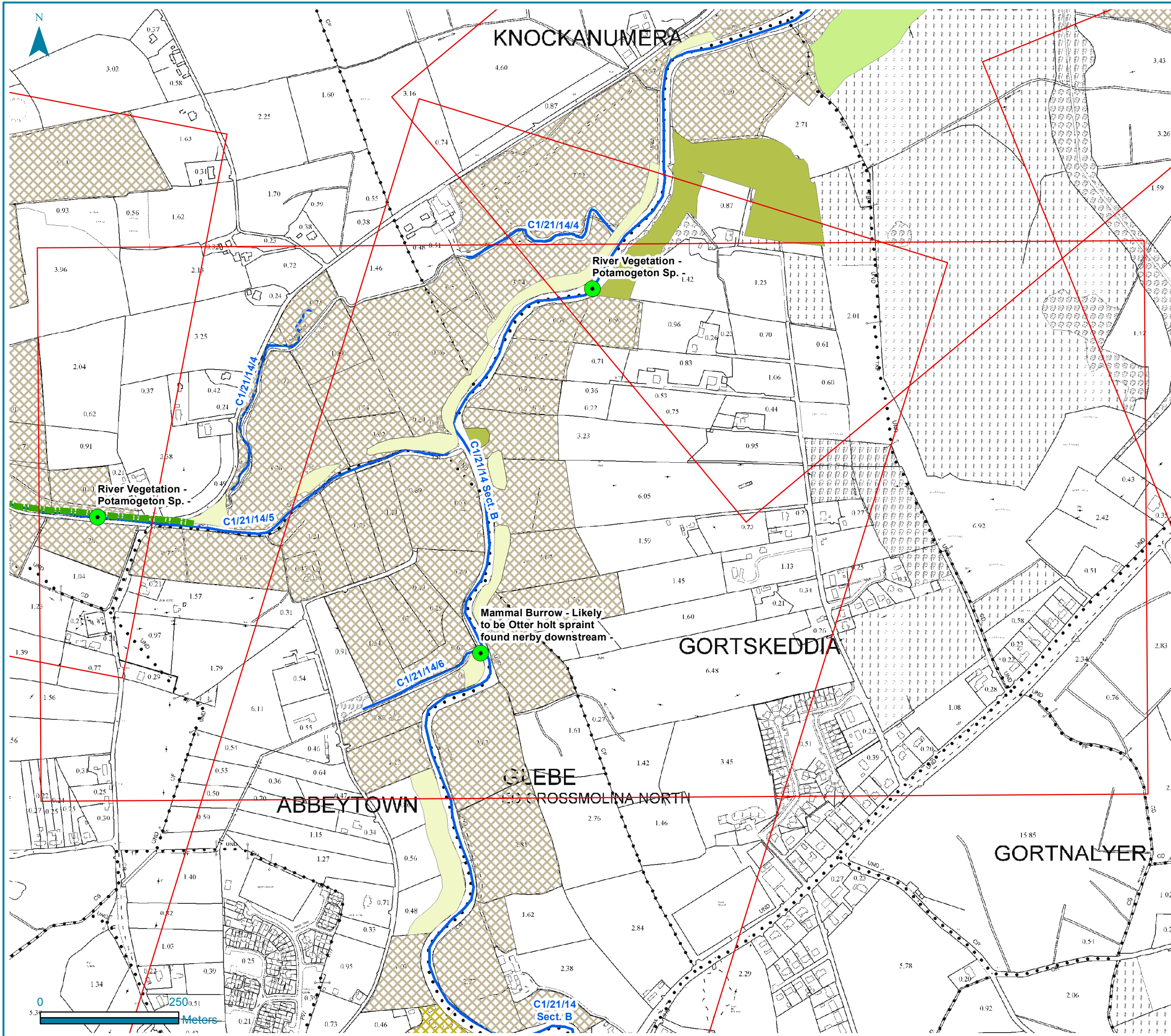
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Legend

- Surveyed channels
- Map Bounds
- Point_Feature(otter_etc)
- Linear Woodland / Scrub**
 - WL2 Treelines
- Woodland and Scrub**
 - WD1 (Mixed) Broadleaved/Conifer Woodland
 - WD4 Conifer Plantation
 - WS1 Scrub
- Grassland and Marsh**
 - GA1 Improved Agricultural Grassland
 - GA2 Amenity Grassland (improved)

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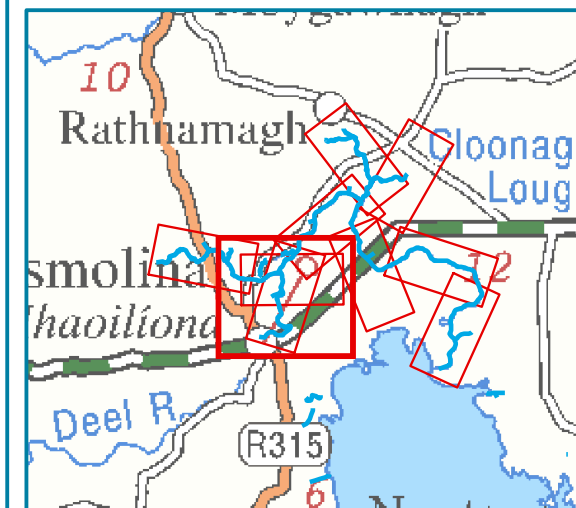
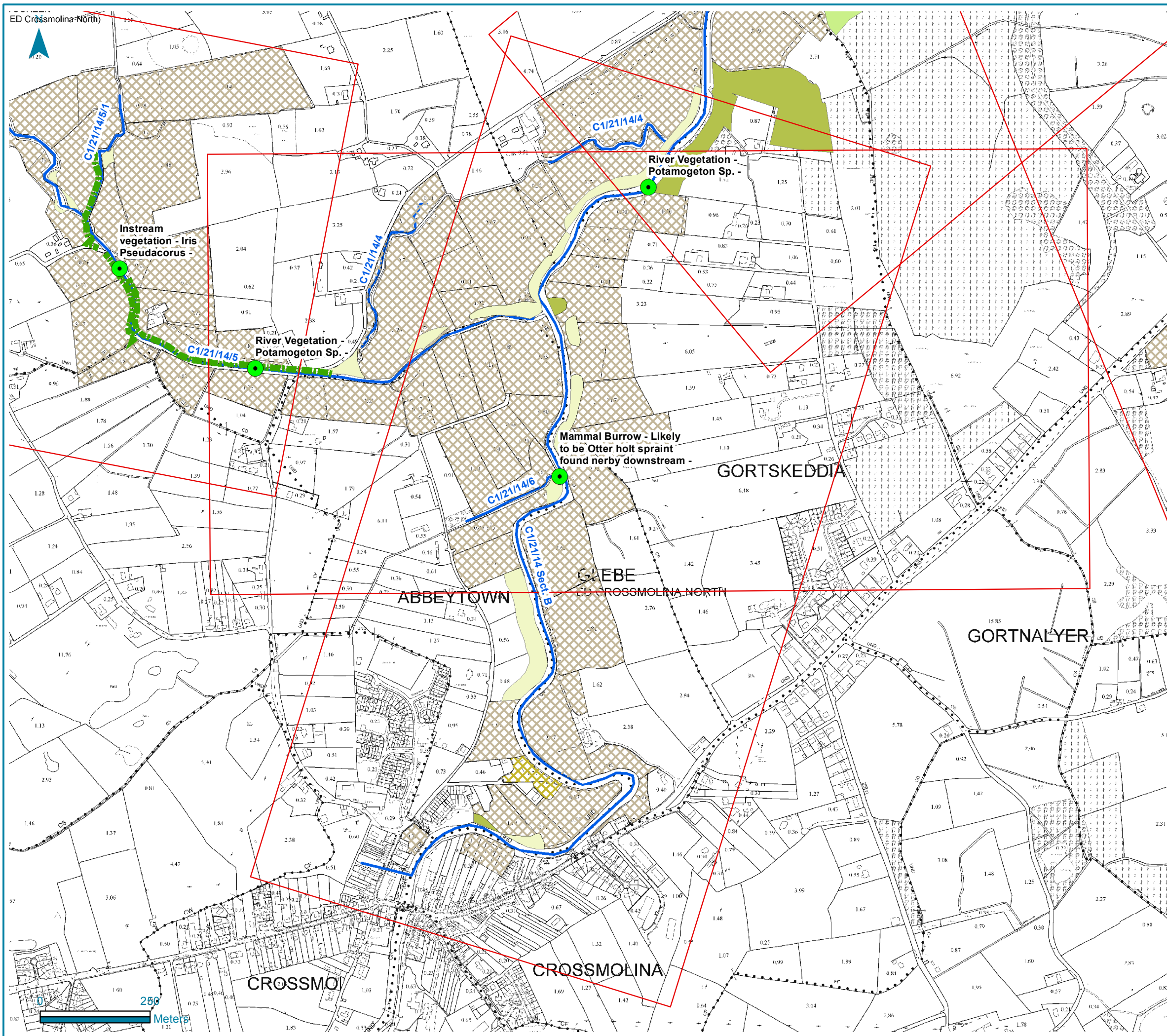
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Legend

Surveyed channels

Map Bounds

Point_Feature(otter_etc)

Linear Woodland / Scrub

WL2 Treelines

Woodland and Scrub

WD1 (Mixed) Broadleaved/Conifer Woodland

WD4 Conifer Plantation

WS1 Scrub

Grassland and Marsh

GA1 Improved Agricultural Grassland

GA2 Amenity Grassland (improved)

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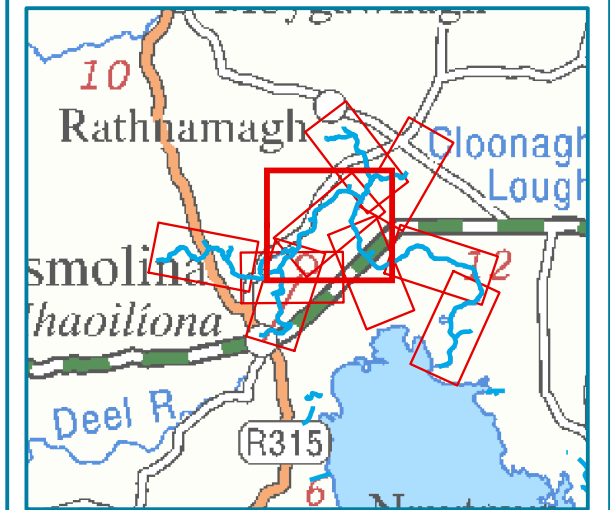
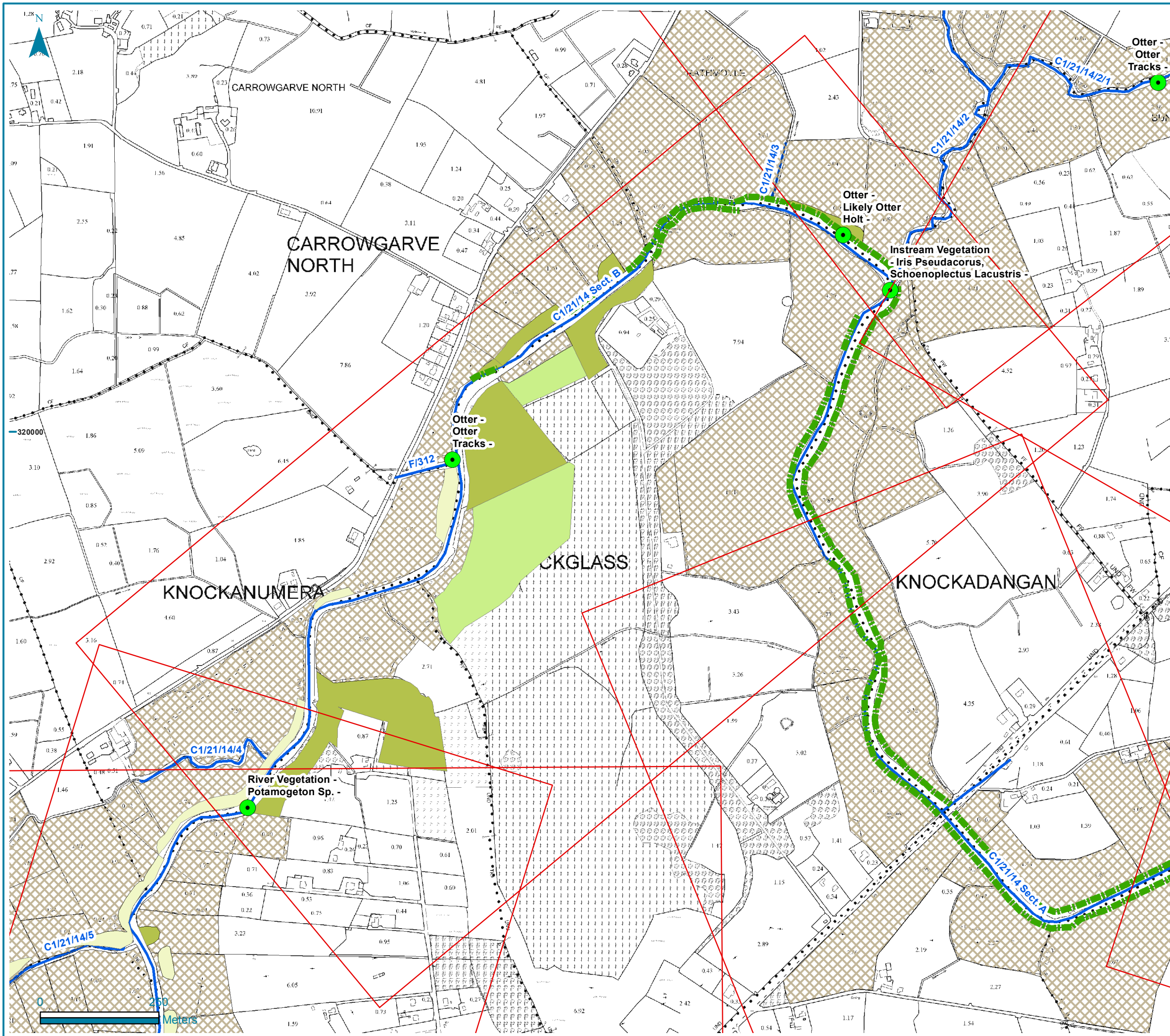
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Legend

- Surveyed channels
- Map Bounds
- Point_Feature(otter_etc)
- Linear Woodland / Scrub**
 - WL2 Treelines
- Woodland and Scrub**
 - WD1 (Mixed) Broadleaved/Conifer Woodland
 - WD4 Conifer Plantation
 - WS1 Scrub
- Grassland and Marsh**
 - GA1 Improved Agricultural Grassland

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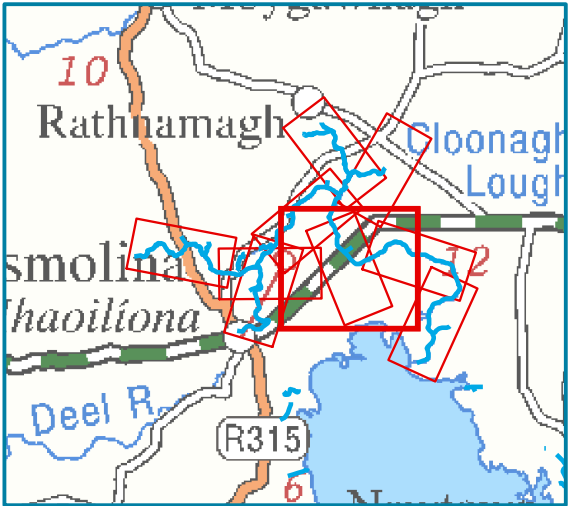
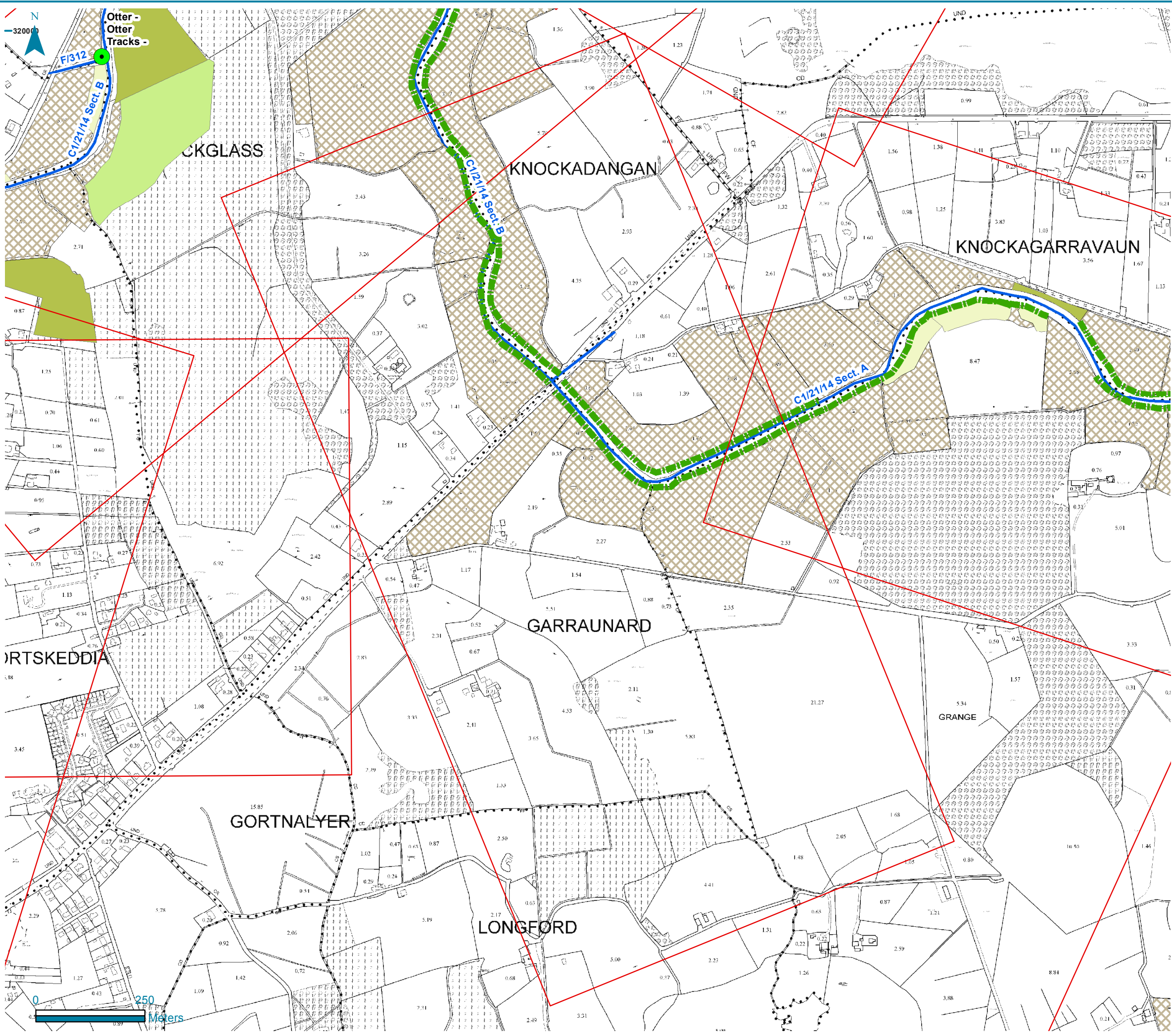
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Status: Survey Specification				



Legend

- Surveyed channels
- Map Bounds
- Point_Feature(otter_etc)

Linear Woodland / Scrub

- WL2 Treelines

Woodland and Scrub

- WD1 (Mixed) Broadleaved/Conifer Woodland
- WD4 Conifer Plantation
- WS1 Scrub

Grassland and Marsh

- GA1 Improved Agricultural Grassland

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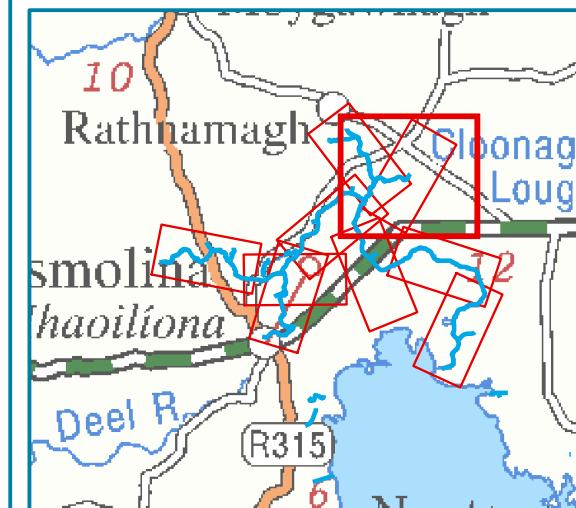
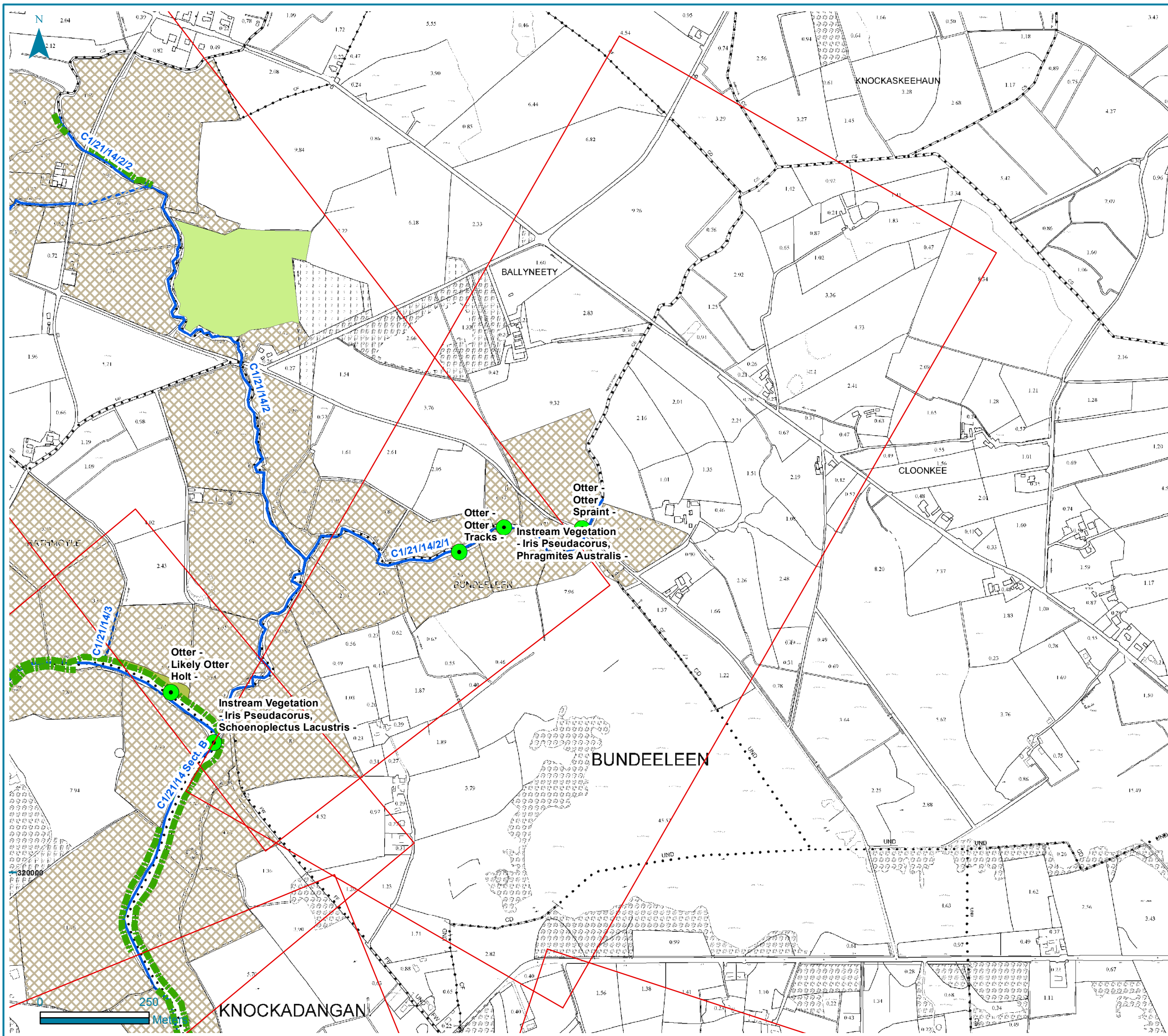
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Legend

Surveyed channels

Map Bounds

Point_Feature(otter_etc)

Linear Woodland / Scrub

WL2 Treelines

Woodland and Scrub

WD1 (Mixed) Broadleaved/Conifer Woodland

WD4 Conifer Plantation

Grassland and Marsh

GA1 Improved Agricultural Grassland

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