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The Management of Invasive Alien Plant Species on National Roads – Technical Guidance

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This document has been authorised by the Director of Professional Services, Transport Infrastructure Ireland. For any further guidance on the TII Publications system, please contact the following:

Contact: Standards and Research Section, Transport Infrastructure Ireland
Postal Address: Parkgate Business Centre, Parkgate Street, Dublin 8, D08 DK10
Telephone: +353 1 646 3600
Email: infoPUBS@tii.ie

TII Publications

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1. Introduction

1.1 General

Invasive Alien Plant Species (IAPS) are species that are introduced intentionally or unintentionally that can threaten native biodiversity, human health and ecosystem services, and potentially damage infrastructure, agricultural practices and forestry. The economic costs of treating invasive alien species (IAS) in Europe have been estimated at approximately €12.5 billion a year, a figure that is rising with increased travel and trade (BiodivERsA, 2017).

This Technical Document (The Management of Invasive Alien Plant Species on National Roads – Technical Guidance) is based on an extensive literature review and analysis of best practice throughout Europe, and aims to provide the following:

- An overview of IAPS and their interactions with existing and proposed national roads (Section 2)
- An outline of relevant legislation that both drives and regulates the management of IAPS in Ireland (Section 3)
- An outline of the key IAPS management strategies that must be incorporated into the planning, construction practices and maintenance regimes of national roads (Section 4)
- The processes for managing IAPS on national roads in Ireland (Section 5)
- Information on the identification and ecology of IAPS present on Ireland's roadsides (Section 6)

There is increasing awareness and concern over the threats that IAPS pose to Ireland's indigenous biodiversity, and national legislation governing the control of these plant species has been subject to significant revision over the last number of years. Ireland also has international obligations under a number of conventions and various pieces of European legislation to address the increasing threat of IAPS.

As IAPS have the potential to significantly impact national biodiversity, obstruct signage and sightlines at junctions, and damage road infrastructure, Transport Infrastructure Ireland (TII) is providing guidance in this Technical Document for the management of the species most likely to be encountered on existing and proposed national roads. Numerous IAPS have established in Ireland over the last century, many arising as escapees from cultivation, such as Japanese knotweed (*Fallopia japonica*), Winter heliotrope (*Petasites fragrans*) and Giant rhubarb (*Gunnera tinctoria*).

Many of the plants categorised as invasive are those that are capable of growing in nutrient-poor or highly changing environments and have the capacity to survive and thrive in disturbed environments. Many are also problematic due to their capacity to reproduce asexually by fragmentation of a rootstock (e.g. Japanese knotweed) or through massive seed production (e.g. Himalayan balsam (*Impatiens glandulifera*)). The vigorous growth typically displayed by most IAPS allows them to out-compete native vegetation and results in the production of large vast monotypic stands. In conjunction with the loss of floral diversity, faunal diversity is also significantly reduced.

2. An Overview of the Issues

'Alien' or 'non-native' species are defined as those species that have been introduced, either intentionally or unintentionally, outside their natural range. Many of these species live in harmony with Ireland's native species, causing no adverse impacts. However, a few IAPS, such as those plant species that are detailed in this Technical Document, become what is known as 'invasive' as they thrive in native habitats and out-compete the local flora. They not only have negative environmental impacts, but they can also adversely impact on recreational activities and have significant associated economic costs. IAPS are so-called as they typically display one or more of the following characteristics or features:

1. Prolific reproduction through seed dispersal and/or re-growth from plant fragments
2. Rapid growth in typically unfavourable habitats
3. Resistance to standard weed control methods

IAPS have in common the ability to spread aggressively by seed or vegetative means, particularly in open or disturbed sites. They can produce large monodominant colonies that threaten biodiversity by outcompeting native plant communities. Typically, they provide a less favourable habitat for some native fauna. When a non-native species displays invasive traits and is not managed, it can potentially

1. Out-compete native vegetation, affecting plant community structure and habitat for wildlife
2. Cause damage to infrastructure including road carriageways, footpaths, walls and foundations (Figure 1)
3. Result in soil erosion and collapse of river banks through exposure of the soil during winter floods when the IAPS die back
4. Have an adverse effect on landscape quality through a loss of naturalness, aesthetics and regional identity
5. Impact on road safety by blocking sightlines at junctions and road signage in general (Dolan, 2004)

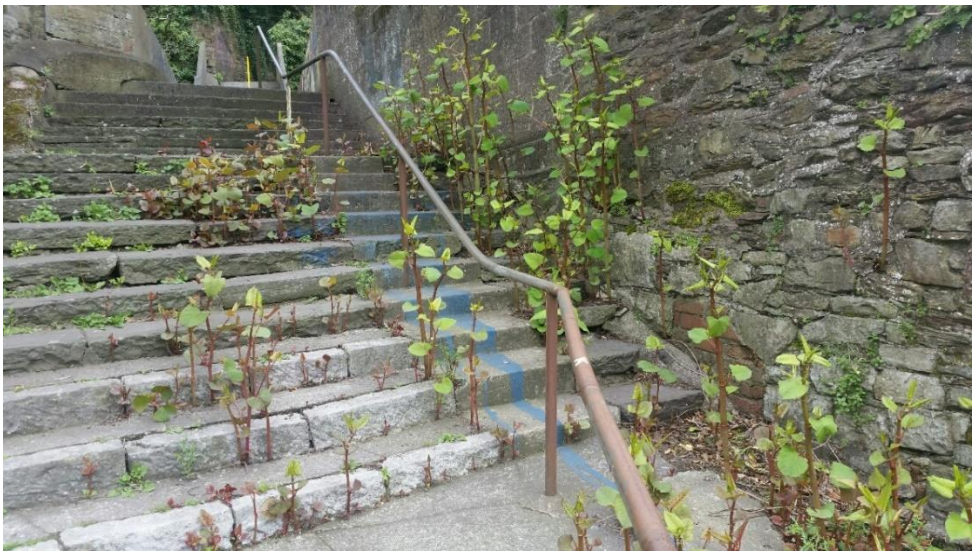

Figure 1 Japanese knotweed breaking through a paved surface [Photo: Arup]

Box 1 Examples of some Impacts of IAPS on Native Habitats and Species

Many IAPS, such as Himalayan balsam and Japanese knotweed, thrive along river banks. Where these two species are present, they can effectively out-compete and exclude the native riparian vegetation. As these plants die back during the winter, the soils become exposed to erosive winter floods, often leading to collapse or subsidence. This in turn gives rise to instream siltation that can clog the spawning gravels used by salmonids and other fish species. It can also result in direct mortality of the internationally rare and protected Freshwater pearl mussel (*Margaritifera margaritifera)*. Further spread of these invasive plants downstream is likely *via* fragmentation and seeds.

Photograph: Infestation of Himalayan balsam and Japanese knotweed along the River Feale, County Kerry [Photograph: Kerry NRO.]

2.1 Invasive Alien Plant Species and National Roads

Roadsides play an important role in facilitating the spread of IAPS by providing suitable habitats for their establishment, as well as serving as corridors that allow them to spread (Matlack & Christen, 2006). The spread of IAPS along national roads is of particular importance to TII. It is vital that practical measures to control the establishment, growth and spread of IAPS are incorporated into the planning, construction practices and maintenance regimes of national roads. Machinery, construction equipment and soil/gravel/stones used in the construction of new roads can introduce new IAPS and disperse them to new areas, while the disturbance of invasive vegetation during road maintenance can disperse seeds and plant fragments (by wind, on Personal Protective Equipment (PPE), equipment and vehicles). Strimming of IAPS during road maintenance activities can significantly contribute to the spread of a number of key IAPS.

Early identification and rapid management of IAPS can significantly reduce the resources needed to minimise the spread of these species.

Figure 2 illustrates the differences between inefficient and efficient approaches to IAPS management and the potential costs associated with the former (Construction Industry Research and Information Association (CIRIA), 2008).

The aim of this Technical Document is to provide guidance for personnel involved in national road planning, construction, operation and maintenance to effectively manage IAPS, while ensuring their own activities do not contribute to the introduction and spread of these species.

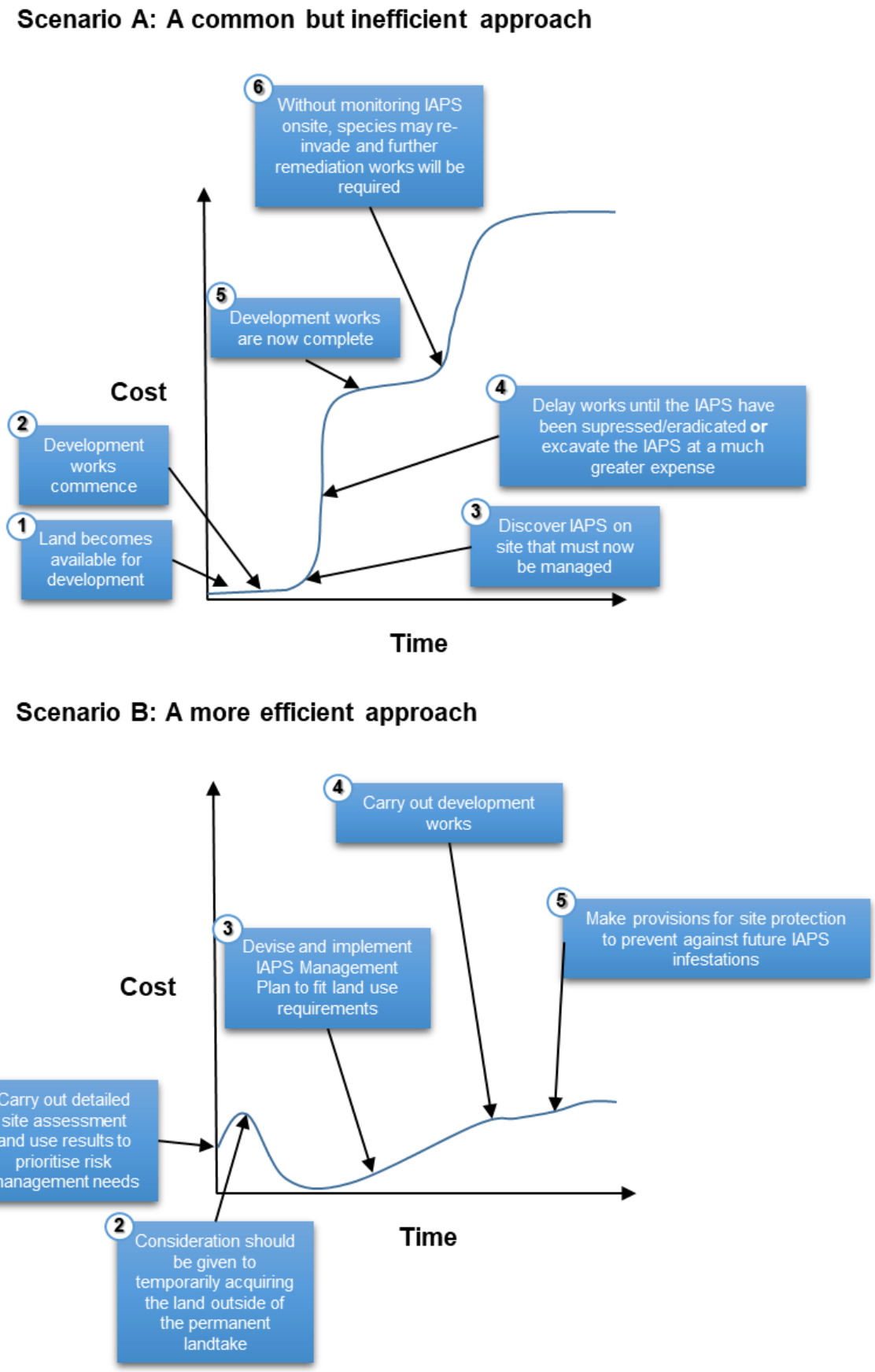

Figure 2 **Inefficiencies in common approaches to invasive species management (***adapted from CIRIA, 2008***)**

As will be seen in Section 3.1, certain pieces of law drive the management of IAPS. For example, the inclusion of a species on: the list of Invasive Alien Species of Union concern; or, the Third Schedule to the Habitats Regulations (see Table 1 below) creates a certain impetus to manage such species. However, it is important to note that there may still be a requirement to manage IAPS other than those specifically listed in legislation. For example, as public authorities, in the exercise of their functions, must take appropriate steps to avoid, in European Sites, the deterioration of natural habitats and the habitats of species,[1] they may be required in certain circumstances to prevent the spread of all IAPS to or within European sites. Also by way of example, it is arguable that one is also bound to consider IAPS not listed in legislation when carrying out Appropriate Assessment and Environmental Impact Assessment. This document deals with certain IAPS not listed in legislation that are commonly encountered on national roads in Ireland. However, there may be species not dealt with in this document that still need consideration.

Table 1 Commonly encountered IAPS on national road projects linked to relevant legislation

	Species Name	Invasive alien species of Union concern (IAS Regulation)	Third Schedule to the Habitats Regulations
Main IAPS dealt with in the draft Standard	Japanese knotweed		•
	Giant knotweed		•
	Bohemian knotweed		•
	Himalayan knotweed		•
	Giant hogweed	•	•
	Himalayan balsam	•	•
	Giant rhubarb	•	•
	Monbretia		
	Winter heliotrope		
	Old man's beard		
	Rhododendron		•
	Buddleia		
Invasive Alien Plant Species of Potential Concern	Himalayan honeysuckle		
	Russian vine		
	Spanish bluebell		•
	Three-cornered leek		•

[1] Regulation 27(3) of the European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No. 477 of 2011)

3. The Legislative Framework

The law relating to the management of IAPS may be divided into two categories. In the first category, there is law that provides an impetus or driver to manage IAPS. The law falling into this category is presented in Section 3.1. The law also, however, regulates how IAPS are to be managed. The law falling into this category is presented in Section 3.2.

The law relating to the management of IAPS must generally be regarded as complex, evolving and difficult to interpret. Whilst every effort has been made to accurately outline and describe relevant aspects of this law in the following sections, it is stressed that the onus remains on readers to fully understand and comply with pertinent statute, common law and other legislative guidelines or recommendations. The outline of relevant law below has been written at a particular point in time. Whilst this outline will be periodically reviewed and updated, the onus is firmly on readers to ensure they know and comply with current law.

3.1 Law Driving the Management of Invasive Alien Plant Species

This section outlines relevant parts of the following laws that might be considered to drive the management of IAPS in Ireland:

- Invasive Alien Species (IAS) Regulation (refer to Section 3.1.1)
- Wildlife Acts, 1976–2018 (refer to Section 3.1.2)
- European Communities (Birds and Natural Habitats) Regulations, 2011–2015 (refer to Section 3.1.3)
- Law of Torts (refer to Section 3.1.4)
- Planning and Development Acts, 2000–2019 (refer to Section 3.1.5)

3.1.1 Invasive Alien Species Regulation

The IAS Regulation,[2] which entered into force on 1st January, 2015,[3] has the greatest potential to drive the management of invasive alien plant and animal species within the European Union (EU). Central to the regime is the establishment, and regular updating, of a list of IAS considered to be of Union concern ('the Union list').[4] The placing of a species on the Union list activates a number of obligations on Member States (MS) *vis-à-vis* those species. Of particular note, the Regulation states '*Within 18 months of an invasive alien species being included on the Union list, Member States shall have in place effective management measures for those invasive alien species of Union concern* [...].'[5]

[2] Regulation (EU) No. 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species [2014] OJ L 317/35

[3] Article 33 of Regulation (EU) No. 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species [2014] OJ L 317/35

[4] Recital 10 of the Preamble to Regulation (EU) No. 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species [2014] OJ L 317/35

[5] Article 19 of Regulation (EU) No. 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species [2014] OJ L 317/35

Whilst the Regulation imposes obligations on MS, they themselves may then impose obligations on their citizens, companies, etc.

For example, '[…] *Member States may impose obligations on holders or users of alien species as well as owners and tenants of the land concerned*.'[6] MS are required to '*take all necessary steps to prevent the unintentional introduction or spread, including, where applicable, by gross negligence, of invasive alien species of Union concern*.'[7] Such steps may include the introduction of legislation prohibiting the unintentional introduction or spread of such species. MS may also establish civil liability regimes. In this context, and with reference to the polluter pays principle, the Regulation states '*Member States shall aim to recover the costs of the measures needed to prevent, minimise or mitigate the adverse impact of invasive alien species, including environmental and resources costs as well as the restoration cost*.'[8]

As the IAS Regulation requires MS to put in place effective management measures and may require such MS to create criminal and civil liability regimes in respect of IAS of Union concern, the Regulation has the potential to provide an extremely strong impetus to MS, emanations of such States (such as public authorities), and natural and legal persons, to manage IAS.

At the date of writing (15th of August, 2019), the Union list includes three IAPS that are likely to be encountered on existing or proposed Irish national roads: Giant rhubarb, Giant hogweed (*Heracleum mantegazzianum*) and Himalayan balsam.[9] Whilst a number of IAPS likely to be encountered are not currently listed, the following should be noted:

- 'Member States may establish a national list of invasive alien species of Member State concern' and apply many of the measures provided for in the Regulation[10]
- The list should be 'regularly updated,'[11] so relevant IAPS may be included in the future

[6] Recital 34 of the Preamble to Regulation (EU) No. 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species [2014] OJ L 317/35

[7] Article 7(2) of Regulation (EU) No. 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species [2014] OJ L 317/35

[8] Article 21 of Regulation (EU) No. 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species [2014] OJ L 317/35

[9] See Commission Implementing Regulation (EU) 2016/1141 of 13 July 2016 adopting a list of invasive alien species of Union concern pursuant to Regulation (EU) No 1143/2014 of the European Parliament and of the Council [2016] OJ L 189/4 and Commission Implementing Regulation (EU) 2017/1263 of 12 July 2017 updating the list of invasive alien species of Union concern established by Implementing Regulation (EU) 2016/1141 pursuant to Regulation (EU) No 1143/2014 of the European Parliament and of the Council [2017] OJ L 182/37

[10] Article 12 of Regulation (EU) No. 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species [2014] OJ L 317/35

[11] Recital 10 of the Preamble to Regulation (EU) No. 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species [2014] OJ L 317/35

3.1.2 Wildlife Acts, 1976–2018

The Wildlife Act, 1976, as amended, provides that '*Any person who*— [...] *plants or otherwise causes to grow in a wild state in any place in the State any* ['*exotic*'[12]] *species of flora, or the flowers, roots, seeds or spores of* ['*exotic*'[13]] flora, [...] *otherwise than under and in accordance with a licence* […] *shall be guilty of an offence*.'[14] Here, according to Comerford (2001), 'exotic' is used in the botanical sense of being non-native. Therefore, any person causing IAPS to grow in a wild state is potentially guilty of an offence. The scope of the section may, however, be significantly limited as it has been suggested (Milloy, 2014) that '*"the wild" would not include private land*.'

3.1.3 European Communities (Birds and Natural Habitats) Regulations, 2011–2015

Regulation 49 of the European Communities (Birds and Natural Habitats) Regulations, 2011,[15] which concerns '*Prohibition on introduction and dispersal of certain species*', provides a strong impetus to manage IAPS. Regulation 49(2) of the European Communities (Birds and Natural Habitats) Regulations, 2011,[16] provides '*Save in accordance with a licence* [...]*, any person who plants, disperses, allows or causes to disperse, spreads or otherwise causes to grow*' scheduled plant species shall be guilty of an offence. Scheduled plant species (listed in Part 1 of the Third Schedule of the Regulation) of relevance to new and existing national roads include the following:

- Giant hogweed
- Giant knotweed (*Fallopia sachalinensis*)
- Giant rhubarb
- Himalayan balsam
- Himalayan knotweed (*Persicaria wallichii*)
- Japanese knotweed
- Rhododendron (*Rhododendron ponticum*)
- Three-cornered leek (*Allium triquetrum*)[17]

The offence under Regulation 49(2) is quite serious; a person who commits such an offence is liable:

a) on summary conviction, to a Class A fine ['"class A fine" means a fine not exceeding €5,000',[18]] or imprisonment for a term not exceeding six months, or both, or

[12] Section 52(8) of the Wildlife Act, 1976, as inserted by 56(d) of the Wildlife (Amendment) Act, 2000

[13] Section 52(8) of the Wildlife Act, 1976, as inserted by 56(d) of the Wildlife (Amendment) Act, 2000

[14] Section 52(7)(c) of the Wildlife Act, 1976, as inserted by 56(d) of the Wildlife (Amendment) Act, 2000

[15] Regulation 49 of the European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No. 477 of 2011)

[16] Regulation 49(2) of the European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No. 477 of 2011)

[17] Part 1 of the Third Schedule to the European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No. 477 of 2011)

[18] Section 3 of the Fines Act, 2010

b) on conviction on indictment, to a fine not exceeding €500,000, or imprisonment for a term not exceeding three years, or both.[19]

The fact that a person allowing the spread or dispersal of scheduled IAPS could be subject to such a serious penalty clearly provides a strong incentive to avoid such spread or dispersal through management measures. It is arguable that the simultaneous creation of a 'reasonable care and due diligence' defence in respect of the offence created under Regulation 49(2) increases this incentive. Regulation 49(3) provides, *inter alia*, '[...] *it shall be a defence to a charge of committing an offence under paragraph* [...] *(2) to prove that the accused took all reasonable steps and exercised all due diligence to avoid committing the offence*.'[20] Therefore, if one takes all reasonable steps and exercises all due diligence to avoid allowing the spread or dispersal of relevant IAPS (e.g. through appropriate management), and one can prove same, one could potentially avail of the defence provided.

3.1.4 Law of Torts

The Law of Torts and, in particular, the tort of private nuisance, could influence a person to manage IAPS growing on their land.

Milloy (2014), writing on Japanese knotweed, points to a UK case in 1990 where '*the Court of Appeal held that where an individual has on their land a naturally occurring hazard which poses a threat to neighbours, there was a duty to do what was reasonable in the circumstances to remove or reduce the hazar*d.' On the same topic, Twining (2010) states '*In the event of a neighbour failing to cooperate, a legal action may be commenced seeking various remedies including damages equating to the cost of treatment and possibly diminution in value of his land and injunctions enforcing the neighbour to carry out specific methods of treatment*.' This area of law has seen a recent, and potentially significant, development in the case of *Williams v. Network Rail Infrastructure Ltd*.[21] Here, Japanese knotweed rhizomes had spread from a railway embankment owned by Network Rail onto the properties of Messrs Williams and Waistell, leading to a diminution in the value of their houses. The Cardiff County Court awarded the Claimants damages for both the cost of remedial action and the diminution in the value of their properties (Proddow & Bentley, 2017). On appeal, the Court of Appeal upheld the decision of the Cardiff County Court, albeit for different reasons.[22]

Whilst the tort of private nuisance could influence a person to manage Japanese knotweed and perhaps other IAPS growing on their land, the following might be of relevance in an Irish context:

- The UK cases described previously are not binding authorities (Cummins, 2019, p. 33) and would only be of persuasive precedence in Ireland
- The Irish tort of nuisance may be more restrictive (Mansfield, 2017)
- Local authorities are traditionally not liable for non-feasance (McMahon & Binchy, 2000) ('*nonfeasance* n. *Failure to perform an act required by law*. […]' (Oxford University Press, 2003))

[19] Regulation 67(2) of the European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No. 477 of 2011), as amended by Regulation 13 of the European Communities (Birds and Natural Habitats) (Amendment) Regulations, 2015 (S.I. No. 355 of 2015)

[20] Regulation 49(3) of the European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No. 477 of 2011)

[21] Joined case of *Williams v Network Rail Infrastructure Ltd* [2017] UK CC (2 February 2017), also known as *Waistell v Network Rail Infrastructure Ltd*.

[22] *Network Rail Infrastructure Limited v. Stephen Williams and Robin Waistell* [2018] EWCA Civ 1514. Available at: https://www.judiciary.uk/wp-content/uploads/2018/07/network-rail-v-williams-judgment.pdf

McCann FitzGerald (2018), in a commentary on the Court of Appeal's judgment in Cardiff, provide the following caution, however:

> *"[…] We can expect similar claims in Ireland, where claimants, to establish a burden to act, will rely on the fact the European Communities (Birds and Habitats) Regulations 2011 made it an offence to plant, disperse, allow or cause to disperse, spread or grow specified invasive species, including Japanese knotweed.*
>
> *Those responsible for transport, water, gas and other linear infrastructure projects are particularly exposed, given the opportunity for knotweed transfer over long distances. […]"*

3.1.5 Planning and Development Acts, 2000–2019

The Planning and Development Acts, 2000–2019, also provide a strong impetus to manage IAPS, particularly to those seeking planning permission in respect of proposed development in Ireland. The fact that Irish planning authorities are beginning to impose planning conditions requiring the management of Japanese knotweed is another example of a legislative-related driver promoting the management of IAPS in Ireland.

3.2 Law Regulating the Management of Invasive Alien Plant Species

As indicated in the introduction to Section 3, the law regulates how IAPS are to be managed. In this section, key aspects of the law are examined. In particular, this section examines legislation relating to:

- The use of plant protection products (PPPs) and the sustainable use of pesticides (refer to Section 3.2.1)
- The management of waste (refer to Section 3.2.2)
- Health and safety (refer to Section 3.2.3)
- Birds and habitats (refer to Section 3.2.4)

3.2.1 Use of Plant Protection Products and Sustainable Use of Pesticides

Legislation regulating the use of PPPs and the sustainable use of pesticides significantly impacts the management of IAPS. Those involved in managing IAPS with pesticides will need to be aware of, and comply with, this law. A non-exhaustive and non-definitive guide to the legislation governing the use of PPPs is provided in Section 3.2.1.1 and the sustainable use of pesticides is provided in Section 3.2.1.2. This legislation must generally be regarded as complex, evolving and difficult to interpret. Therefore, great care is required by users to ensure that the relevant legislation is fully researched and understood. Where any doubt remains as to the applicability and interpretation of relevant legislation, it is recommended that professional legal advice be obtained.

3.2.1.1 Use of Plant Protection Products

The legislation governing the use of PPPs includes the following:

- Regulation (EC) No. 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC (hereinafter referred to as the 'Plant Protection Products Regulation')
- European Communities (Plant Protection Products) Regulations, 2012 (S.I. No. 159 of 2012)

The Plant Protection Products Regulation, *inter alia*, lays down rules for the use of PPPs within the EU.[23] The Regulation applies to PPPs intended, *inter alia*, for destroying undesired plants; therefore, it is clearly applicable to the use of plant protection products to control IAPS.[24]

The use of PPPs, according to the Preamble to the Plant Protection Products Regulation (159/2012), '*may involve risks and hazards for humans, animals and the environment, especially if used incorrectly*.'[25] It is important, therefore, that PPPs are used correctly so as to reduce the risks and hazards for humans, animals and the environment.

The Preamble indicates that PPPs should be used:

- In accordance with their authorisation
- Having regard to the principles of integrated pest management
- Giving priority to non-chemical and natural alternatives wherever possible[26]

As non-chemical and natural alternatives may be of limited use in treating many IAPS, and as the principles of integrated pest management are only of partial relevance, those treating IAPS should ensure, in particular, that they use PPPs correctly and in accordance with their authorisation.

The Preamble to the Regulation indicates further that the user should know from the product label where, when and under what circumstances a PPP may be used.[27] **The importance of ensuring that PPPs are used in accordance with the product label cannot be over-emphasised**.

The Plant Protection Products Regulation provides that PPPs can be approved by MS, subject to conditions and restrictions, including:

- Manner and conditions of application
- Designation of categories of users (such as professional and non-professional)
- Designation of areas where the use of PPPs may not be authorised or where the use may be authorised under specific conditions

[23] Article 1(1) of Regulation (EC) No. 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC

[24] Article 2(1) of Regulation (EC) No. 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC

[25] Recital 7 of the Preamble to Regulation (EC) No. 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC

[26] Recital 35 of the Preamble to Regulation (EC) No. 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC

[27] Recital 36 of the Preamble to Regulation (EC) No. 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC

- The need to impose risk mitigation measures and monitoring after use[28]

Those using PPPs to treat IAPS will need to be familiar, and comply, with such conditions and restrictions.

Notably, Article 55 of the Plant Protection Products Regulation requires that PPPs shall be used properly, where proper use includes:

- Application of the principles of good plant protection practice
- Compliance with the conditions laid down in the contents of authorisation (refer to Article 31 in S.I. 159/2012) and specified on the labelling[29]

Those managing IAPS using PPPs should be familiar with the principles of good plant protection practice, which are published by the Minister for Agriculture, Food and the Marine.[30]

3.2.1.1.1 Contents of authorisation

Those proposing to use PPPs to manage IAPS should be well informed of the contents of authorisation. Article 31(1) of the Plant Protection Products Regulation states:

> *'The authorisation shall define plants or plant products and non-agricultural areas (for example railways, public areas, storage rooms) on which and the purposes for which the plant protection product may be used.'*[31]

Article 31(2) states that the authorisation shall set out the requirements relating to the use of PPPs.[32] Furthermore, Article 31(3) provides that the authorisation must also include, where applicable: (a) the maximum dose per hectare in each application; (b) the period between the last application and harvest; and, (c) the maximum number of applications per year.[33] Article 31(4) provides that the requirements relating to the use of the PPPs may include, *inter alia*:

- A restriction with respect to the use of the PPPs in order to protect the health of the users, bystanders, residents or the environment (such restriction shall be included on the label)

[28] Article 6 of Regulation (EC) No. 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC

[29] Article 55 of Regulation (EC) No. 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC

[30] Regulation 15 of the European Communities (Sustainable Use of Pesticides) Regulations, 2012 (S.I. No. 155 of 2012)

[31] Article 31(1) of Regulation (EC) No. 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC

[32] Article 31(2) of Regulation (EC) No. 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC

[33] Article 31(3) of Regulation (EC) No. 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC

- The obligation before the product is used to inform any neighbours who could be exposed to the spray drift and who have requested to be informed
- Indications for proper use according to the principles of Integrated Pest Management
- Designation of categories of users, such as professional and non-professional
- The approved label[34]

3.2.1.1.2 Register of authorised and permitted plant protection products

It should be noted that the Plant Protection Products Regulation provides that the Minister for Agriculture, Food and the Marine may establish a register of authorised and PPPs.[35] PPPs cannot, subject to certain exceptions, be used unless they have been entered on the register or granted a trial permit.[36] Those proposing the use of PPPs should check to ensure that the product is entered on the register (refer to http://www.pcs.agriculture.gov.ie/products/) or has been granted a trial permit.

3.2.1.1.3 Record keeping

In relation to 'record keeping', Article 67(1) of the Plant Protection Products Regulation provides, *inter alia*, that '[p]*rofessional users of plant protection products shall, for at least three years, keep records of the plant protection products they use, containing the name of the plant protection product, the time and the dose of application, the area and the crop where the plant protection product was used*.'[37] Regard should be had to Regulation 16 of the Plant Protection Products Regulation, in relation to record keeping.[38]

3.2.1.2 Sustainable use of pesticides

The legislation governing the sustainable use of pesticides includes the following:

- Directive 2009/128/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides (hereinafter referred to as the Sustainable Use of Pesticides Directive)
- European Communities (Sustainable Use of Pesticides) Regulations, 2012, (S.I. No. 155 of 2012), as amended by the European Communities (Sustainable Use of Pesticides) (Amendment) Regulations, 2019 (S.I. No. 438 of 2019) (hereinafter referred to as the Sustainable Use of Pesticides Regulations)

[34] Article 31(4) of Regulation (EC) No. 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC

[35] Regulation 13(1) of European Communities (Plant Protection Products) Regulations, 2012 (S.I. No. 159 of 2012)

[36] Regulation 14 of European Communities (Plant Protection Products) Regulations, 2012 (S.I. No. 159 of 2012)

[37] Article 67(1) of Regulation (EC) No. 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC

[38] Regulation 16 of European Communities (Plant Protection Products) Regulations, 2012 (S.I. No. 159 of 2012)

3.2.1.2.1 National Action Plan

The Sustainable Use of Pesticides Directive requires MS to establish National Actions Plans '[...] *aimed at setting quantitative objectives, targets, measures, timetables and indicators to reduce risks and impacts of pesticide use on human health and the environment and at encouraging the development and introduction of integrated pest management and of alternative approaches or techniques in order to reduce dependency on the use of pesticides* [...].'[39]

Those engaged in treating IAPS with pesticides should note that at the time of writing (15th of August, 2019), the contents of Ireland's National Action Plan have recently been revised and are available for download at: http://www.pcs.agriculture.gov.ie/sud/

3.2.1.2.2 Advisors and professional users

Those persons seeking to manage IAPS using pesticides must ensure that they procure the services of registered and appropriately trained advisors and professional users, where this is required.

3.2.1.2.3 Advisors

Article 3(3) of the Sustainable Use of Pesticides Directive defines the term 'advisor' in the following manner:

> *'advisor' means any person who has acquired adequate knowledge and advises on pest management and the safe use of pesticides, in the context of a professional capacity or commercial service, including private self-employed and public advisory services, commercial agents, food producers and retailers where applicable;*[40]

In relation to '*Register*', Regulation 4(1)(d) of the Sustainable Use of Pesticides Regulations provides, *inter alia*, that '[The Minister may establish a register of–] *advisors on the use of pesticides.*'[41] Regulation 4(2) provides that '*The Minister may set conditions for registration under paragraph (1).*'[42]

3.2.1.2.4 Professional users

Where it is proposed to use professionals to treat IAPS, clients will need to ensure that 'professional users of pesticides' have appropriate training and are registered.

[39] Recital 12 of the Preamble to Directive 2009/128/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides

[40] Article 3(3) of Directive 2009/128/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides

[41] Regulation 4(1)(d) of the European Communities (Sustainable Use of Pesticides) Regulations, 2012 (S.I. No. 155 of 2012)

[42] Regulation 4(2) of the European Communities (Sustainable Use of Pesticides) Regulations, 2012 (S.I. No. 155 of 2012)

Training

The Sustainable Use of Pesticides Directive requires MS to '[...] *set up systems of both initial and additional training for* [...] *professional users of pesticides and certification systems to record such training so that those who use or will use pesticides are fully aware of the potential risks to human health and the environment and of the appropriate measures to reduce those risks as much as possible*.'[43] Regulation 5(1) of the Sustainable Use of Pesticides Regulations, states, *inter alia,* that a professional user of pesticides shall:

- *"hold a certificate confirming that the professional user has been trained to a standard determined by the Minister in the subjects listed in Annex I of the Directive";*[44] *and,*
- *"comply with any additional training requirements as determined by the Minister".*[45]

Register of professional users

Regulation 4 of the Sustainable Use of Pesticides Regulations grants the Minister for Agriculture, Food and the Marine the power to establish a register of professional users and any class or classes of professional users.[46] The Minister is also granted the power to set conditions for registration.[47] Regulation 5(1)(a) of the Sustainable Use of Pesticides Regulations, states that a professional user of pesticides shall '*be entered in the Register*'.[48] Furthermore, Regulation 5(3) provides that '*A person shall not act as a professional user unless he or she is entered in the Register*.'[49]

Regulation 5(2) provides that the Minister for Agriculture, Food and the Marine may remove a professional user from the Register, where the professional user:

a) ceases to be a professional user,

b) fails to comply with any additional training requirements, or

c) has been found guilty of an offence resulting in:

   i) misuse of pesticides, or

[43] Recital 8 of the Preamble to Directive 2009/128/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides

[44] Regulation 5(1)(b) of European Communities (Sustainable Use of Pesticides) Regulations, 2012 (S.I. No. 155 of 2012), as substituted by Regulation 2(b) of the European Communities (Sustainable Use of Pesticides) (Amendment) Regulations, 2019 (S.I. No. 438 of 2019)

[45] Regulation 5(1)(c) of European Communities (Sustainable Use of Pesticides) Regulations, 2012 (S.I. No. 155 of 2012), as substituted by Regulation 2(b) of the European Communities (Sustainable Use of Pesticides) (Amendment) Regulations, 2019 (S.I. No. 438 of 2019)

[46] Regulation 4(1) of European Communities (Sustainable Use of Pesticides) Regulations, 2012 (S.I. No. 155 of 2012)

[47] Regulation 4(2) of European Communities (Sustainable Use of Pesticides) Regulations, 2012 (S.I. No. 155 of 2012)

[48] Regulation 5(1)(a) of European Communities (Sustainable Use of Pesticides) Regulations, 2012 (S.I. No. 155 of 2012), as substituted by Regulation 2(b) of the European Communities (Sustainable Use of Pesticides) (Amendment) Regulations, 2019 (S.I. No. 438 of 2019)

[49] Regulation 5(3) of European Communities (Sustainable Use of Pesticides) Regulations, 2012 (S.I. No. 155 of 2012), as substituted by Regulation 2(b) of the European Communities (Sustainable Use of Pesticides) (Amendment) Regulations, 2019 (S.I. No. 438 of 2019)

ii) water pollution.[50]

It is, therefore, important that those employing professional users of pesticides in the management of IAPS ensure that the users are, and continue to be, entered on the register for the duration of the works.

Information relating to professional users and the register is available on the website of the Pesticide Registration and Controls Divisions (PRCD) of the Department of Agriculture, Food and the Marine (DAFM): http://www.pcs.agriculture.gov.ie/sud/professionalusersprayeroperators/

3.2.1.2.5 Health and safety requirements in the workplace

In relation to 'Health and Safety Requirements in the Workplace', Recital 12 of the Preamble to the Sustainable Use of Pesticides Directive provides:

> *"To the extent that the handling and application of pesticides require the setting of minimum health and safety requirements at the workplace, covering the risks arising from exposure of workers to such products, as well as general and specific preventive measures to reduce those risks, those measures are covered by Council Directive 98/24/EC of 7 April 1998 on the protection of the health and safety of workers from the risks related to chemical agents at work and Directive 2004/37/EC of the European Parliament and of the Council of 29 April 2004 on the protection of workers from the risks related to their exposure to carcinogens or mutagens at work."*[51]

3.2.1.2.6 Technical inspection of pesticide application equipment

The Sustainable Use of Pesticides Directive states that '*in order to minimise the adverse impacts of pesticides on human health and the environment*', MS have '*to provide for systems for regular technical inspection of pesticide application equipment already in use*.'[52] Ireland responded to this requirement through, *inter alia*, Regulation 9 of the Sustainable Use of Pesticides Regulations. Pursuant to Regulation 9(2), the Minister for Agriculture, Food and the Marine must establish and maintain a list (to be published on a website[53]) specifying:

a) The type or class of pesticide application equipment to be inspected and certified;

b) The standard each type or class of equipment is required to meet; and,

[50] Regulation 5(2) of European Communities (Sustainable Use of Pesticides) Regulations, 2012 (S.I. No. 155 of 2012), as substituted by Regulation 2(b) of the European Communities (Sustainable Use of Pesticides) (Amendment) Regulations, 2019 (S.I. No. 438 of 2019)

[51] Recital 12 of the Preamble to Directive 2009/128/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides

[52] Recital 13 of the Preamble to Directive 2009/128/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides

[53] Regulation 9(3) of the of European Communities (Sustainable Use of Pesticides) Regulations, 2012 (S.I. No. 155 of 2012), as substituted by Regulation 2(d) of the European Communities (Sustainable Use of Pesticides) (Amendment) Regulations, 2019 (S.I. No. 438 of 2019)

c) The frequency at which each type or class of equipment is to be inspected and certified.[54]

Whilst these inspection and certification requirements relate to certain types or classes of equipment, Regulation 9(5) provides, generally, that '*A professional user shall only apply pesticides with equipment that is correctly calibrated and is appropriate for the use intended*.'[55]

3.2.1.2.7 Areas

It is extremely important to note that the Sustainable Use of Pesticides Directive[56] and related Irish transposing Regulations[57] place additional restrictions and, in some cases, prohibitions, on the use of pesticides in certain specified areas. Such areas include areas for the abstraction of drinking water, transport routes (such as railway lines), areas with sealed or very permeable surfaces, groundwater vulnerable areas, areas used by the general public or defined vulnerable groups, and European sites.

Aquatic environment

The Sustainable Use of Pesticides Directive highlights that the aquatic environment is especially sensitive to pesticides, which means that particular attention is required to avoid contaminating surface water and groundwater when using pesticides.[58] Measures to avoid such pollution may include the establishment of buffer and safeguard zones, and the planting of hedges along surfaces waters to reduce exposure of water bodies to spray drift, drain flow and run-off.[59] The Directive states that the dimensions of buffers zones will depend on the circumstances of each case.[60] The Sustainable Use of Pesticides Directive also indicates that the use of pesticides:

- in areas for the abstraction of drinking water;
- on or along transport routes (such as railway lines); and,
- on sealed or very permeable surface,

[54] Regulation 9(2) of the of European Communities (Sustainable Use of Pesticides) Regulations, 2012 (S.I. No. 155 of 2012), as substituted by Regulation 2(d) of the European Communities (Sustainable Use of Pesticides) (Amendment) Regulations, 2019 (S.I. No. 438 of 2019)

[55] Regulation 9(5) of the of European Communities (Sustainable Use of Pesticides) Regulations, 2012 (S.I. No. 155 of 2012), as substituted by Regulation 2(d) of the European Communities (Sustainable Use of Pesticides) (Amendment) Regulations, 2019 (S.I. No. 438 of 2019)

[56] Directive 2009/128/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides

[57] European Communities (Sustainable Use of Pesticides) Regulations, 2012 (S.I. No. 155 of 2012), as amended by the European Communities (Sustainable Use of Pesticides) (Amendment) Regulations, 2019 (S.I. No. 438 of 2019)

[58] Recital 15 of the Preamble to Directive 2009/128/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides

[59] Recital 15 of the Preamble to Directive 2009/128/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides

[60] Recital 15 of the Preamble to Directive 2009/128/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides

can lead to higher risks of pollution of the aquatic environment.[61] The Directive highlights further that in such areas the pesticide use should, therefore, be reduced as far as possible, or eliminated, if appropriate.[62]

Prohibitions on pesticides near aquatic environment and drinking water

The Sustainable Use of Pesticides Regulations detail '*Prohibitions on pesticides near aquatic environment and drinking water*'.[63]

Regulation 11(1) provides that '*A person shall not use a pesticide within the relevant specified distance of a type or class of water source specified in a list* […].'[64] The Minister for Agriculture, Food and the Marine is required to establish and maintain a list specifying:

- *'the type or class of water source subject of a safeguard zone referred to in Article 11 of the Directive';*[65]
- *'the distance from each type or class of water source that a safeguard zone applies to';*[66] *and,*
- *'where a water source differs significantly in its vulnerability from the standard water source […], such water source and its safeguard zone relevant distance […].'*[67]

This list is required to be published on a website maintained by the Minister.[68] Those involved in the use of pesticides to manage IAPS must make themselves fully aware of this list and relevant safeguard zones, etc.

[61] Recital 15 of the Preamble to Directive 2009/128/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides

[62] Recital 15 of the Preamble to Directive 2009/128/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides

[63] Regulation 11 of European Communities (Sustainable Use of Pesticides) Regulations, 2012 (S.I. No. 155 of 2012), as substituted by Regulation 2(e) of the European Communities (Sustainable Use of Pesticides) (Amendment) Regulations, 2019 (S.I. No. 438 of 2019)

[64] Regulation 11(1) of European Communities (Sustainable Use of Pesticides) Regulations, 2012 (S.I. No. 155 of 2012), as substituted by Regulation 2(e) of the European Communities (Sustainable Use of Pesticides) (Amendment) Regulations, 2019 (S.I. No. 438 of 2019)

[65] Regulation 11(2)(a) of European Communities (Sustainable Use of Pesticides) Regulations, 2012 (S.I. No. 155 of 2012), as substituted by Regulation 2(e) of the European Communities (Sustainable Use of Pesticides) (Amendment) Regulations, 2019 (S.I. No. 438 of 2019). Article 11(2)(c) of the Directive refers to '*the establishment of appropriately-sized buffer zones for the protection of non-target aquatic organisms and safeguard zones for surface and groundwater used for the abstraction of drinking water, where pesticides must not be used or stored*'.

[66] Regulation 11(2)(b) of European Communities (Sustainable Use of Pesticides) Regulations, 2012 (S.I. No. 155 of 2012), as substituted by Regulation 2(e) of the European Communities (Sustainable Use of Pesticides) (Amendment) Regulations, 2019 (S.I. No. 438 of 2019)

[67] Regulation 11(2)(c) of European Communities (Sustainable Use of Pesticides) Regulations, 2012 (S.I. No. 155 of 2012), as substituted by Regulation 2(e) of the European Communities (Sustainable Use of Pesticides) (Amendment) Regulations, 2019 (S.I. No. 438 of 2019)

[68] Regulation 11(3) of European Communities (Sustainable Use of Pesticides) Regulations, 2012 (S.I. No. 155 of 2012), as substituted by Regulation 2(e) of the European Communities (Sustainable Use of Pesticides) (Amendment) Regulations, 2019 (S.I. No. 438 of 2019)

Regulation 11(4) provides that:

> *"Subject to paragraph (5), a person shall not use a pesticide within 50 metres of a landscape feature that is known to be a ground water vulnerable area including exposed cavernous or karstified limestone features (such as swallow-holes and collapse features)."*[69]

The Minister may, however, '*approve an alternative distance* […] *if that alternative is based on a reasoned argument and supported by scientific evidence*.'[70] Such applications for approval of an alternative distance shall be in such form and contain such particulars as the Minister may require.[71]

Regulation 11(7) provides:

> *"Subject to paragraphs (1) and (4), a person shall not use a pesticide close to water other than in accordance with the conditions set out in the approved label for that pesticide."*[72]

Specific areas

In relation to '*Specific Areas*', Regulation 12(1) of the Sustainable Use of Pesticides Regulations provides that, subject to paragraph (2), a person shall not apply a pesticide in:

a) Areas used by the general public or by defined vulnerable groups[73]

b) A European site[74]

'Vulnerable groups' are defined in the Plant Protection Products Regulation to mean '*persons needing specific consideration when assessing the acute and chronic health effects of plant protection products' and include 'pregnant and nursing women, the unborn, infants and children, the elderly and workers and residents subject to high pesticide exposure over the long term*.'[75]

[69] Regulation 11(4) of European Communities (Sustainable Use of Pesticides) Regulations, 2012 (S.I. No. 155 of 2012), as substituted by Regulation 2(e) of the European Communities (Sustainable Use of Pesticides) (Amendment) Regulations, 2019 (S.I. No. 438 of 2019)

[70] Regulation 11(5) of European Communities (Sustainable Use of Pesticides) Regulations, 2012 (S.I. No. 155 of 2012), as substituted by Regulation 2(e) of the European Communities (Sustainable Use of Pesticides) (Amendment) Regulations, 2019 (S.I. No. 438 of 2019)

[71] Regulation 11(6) of European Communities (Sustainable Use of Pesticides) Regulations, 2012 (S.I. No. 155 of 2012), as substituted by Regulation 2(e) of the European Communities (Sustainable Use of Pesticides) (Amendment) Regulations, 2019 (S.I. No. 438 of 2019)

[72] Regulation 11(7) of European Communities (Sustainable Use of Pesticides) Regulations, 2012 (S.I. No. 155 of 2012), as substituted by Regulation 2(e) of the European Communities (Sustainable Use of Pesticides) (Amendment) Regulations, 2019 (S.I. No. 438 of 2019)

[73] Regulation 12(1)(a) of the European Communities (Sustainable Use of Pesticides) Regulations, 2012 (S.I. No. 155 of 2012)

[74] Regulation 12(1)(b) of the European Communities (Sustainable Use of Pesticides) Regulations, 2012 (S.I. No. 155 of 2012)

[75] Article 3(14) of the Regulation (EC) No. 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC.

The term 'European Site' is defined in the European Communities (Birds and Natural Habitats) Regulations, 2011, and includes special areas of conservation and special protection areas.[76] Regulation 12(2) of the Sustainable Use of Pesticides Regulations states, *inter alia*: '*Where a person, having completed a risk assessment, is obliged to use a pesticide in* [a specified] *area* [...] *he or she shall ensure that preference is given to the use of low risk plant protection products or biological and cultural control measures and where such measures are not capable of performing the necessary function, a person shall prioritise the use of plant protection products that are not classified as* R_{50} [...].'[77] Regulation 12(3) provides:

> *Where a person uses a pesticide in an area referred to in paragraph (1) the onus of proof will lie with that person to show that there was no viable alternative and appropriate risk management measures were put in place.*[78]

3.2.1.2.8 Integrated pest management

In relation to '*Integrated pest management*', Regulation 14 of the Sustainable Use of Pesticides Regulations, which commenced on 1st January, 2014,[79] states:

> *14. A professional user shall apply the general principles of integrated pest management as set out in Annex III to the Directive and maintain records to demonstrate the application of such principles.*[80]

3.2.1.2.9 Good plant protection practice

In relation to '*Good plant protection practice*', Regulation 15 of the Sustainable Use of Pesticides Regulations states:

> *15. A professional user shall apply the principles of good plant protection practice as published by the Minister and maintain records to demonstrate the application of such principles.*[81]

3.2.2 Management of Waste

The management of IAPS on national roads must comply with the provisions of the Waste Management Acts, 1996–2011, and related legislation. Those involved in the management of IAPS are referred to TII's document GE-ENV-01101 *The Management of Waste from National Road Construction Projects* (TII) for more information on waste management legislation.

[76] Regulation 2(1) of the European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No. 477 of 2011)

[77] Regulation 12(2) of the European Communities (Sustainable Use of Pesticides) Regulations, 2012 (S.I. No. 155 of 2012)

[78] Regulation 12(3) of European Communities (Sustainable Use of Pesticides) Regulations, 2012 (S.I. No. 155 of 2012)

[79] Regulation 2(5) of European Communities (Sustainable Use of Pesticides) Regulations, 2012 (S.I. No. 155 of 2012)

[80] Regulation 14 of European Communities (Sustainable Use of Pesticides) Regulations, 2012 (S.I. No. 155 of 2012)

[81] Regulation 15 of European Communities (Sustainable Use of Pesticides) Regulations, 2012 (S.I. No. 155 of 2012)

3.2.3 Health and Safety

The focus of this Standard is to provide guidance on the treatment of IAPS in Ireland. While the Standard alludes to various precautionary measures that should be implemented when undertaking various activities to manage or control IAPS, it is of paramount importance that all relevant health and safety legislation is complied with and guidance followed. The following is a non-exhaustive and non-definitive list of legislation and guidance that may be of relevance, depending on the circumstances under which the IAPS are being dealt with:

- Safety, Health and Welfare at Work Act, 2005
- Safety, Health and Welfare at Work (Construction) Regulations, 2013 (S.I. No. 291 of 2013)
- Safety, Health and Welfare at Work (General Application) Regulations, 2007 (S.I. No. 299 of 2007)
- Safety, Health and Welfare at Work (Chemical Agents) Regulations, 2001 (S.I. No. 619 of 2001)
- Regulation (EC) No. 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC
- European Communities (Plant Protection Products) Regulations, 2012 (S.I. No. 159 of 2012)
- Directive 2009/128/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides
- European Communities (Sustainable Use of Pesticides) Regulations, 2012 (S.I. No. 155 of 2012)
- Chapter 8 of the Traffic Signs Manual (Department of Transport)
- Guidance for the Control and Management of Traffic at Road Works (Department of Transport, 2010)
- 2016 Code of Practice for the Chemical Agents Regulations (Health and Safety Authority, 2016)
- Guidelines for Working on Roads (Health and Safety Authority, 2009)
- Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)

3.2.4 Birds and Habitats

As outlined in Section 3.1.3, Regulation 49 of the European Communities (Birds and Natural Habitats) Regulations, 2011,[82] which concerns '*Prohibition on introduction and dispersal of certain species*,' provides a strong impetus to manage IAPS. However, in addition to prompting the management of IAPS, Regulation 49 also regulates how IAPS are to be managed.

As discussed in Section 3.1.3, Regulation 49(2) provides that '*Save in accordance with a licence granted under paragraph (7), any person who plants, disperses, allows or causes to disperse, spreads*

[82] Regulation 49 of the European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No. 477 of 2011)

or otherwise causes to grow' scheduled plant species, such as Japanese and other knotweed species,[83] shall be guilty of an offence.[84]

3.2.4.1 Need to exercise 'reasonable care and due diligence' in management

It is extremely important to note that a 'reasonable care and due diligence' defence has been created in respect of the offence formed by Regulation 49(2), with Regulation 49(3) providing, *inter alia*, '[...] *it shall be a defence to a charge of committing an offence under paragraph* [...] *(2) to prove that the accused took all reasonable steps and exercised all due diligence to avoid committing the offence*.'[85] In the context of such due diligence defences, the Law Reform Commission (2016) states:

> *"In order to avail of the "due diligence" defence an accused is required to produce evidence of positive steps or actions taken in order to prove the absence of negligence. This generally means that a person, corporate body or undertaking must prove that they had taken all reasonable steps by setting up a system to prevent the action which is the subject matter of the criminal act."*

Thus, those engaged in the management of IAPS must be in a position to produce evidence of the positive steps or actions that they have taken to avoid the spread or dispersal of the plant during their management attempts. Applying appropriate biosecurity measures and following appropriate guidance, and, importantly, documenting same, may assist managers in this regard.

3.2.4.2 Need to apply for a licence during management

In addition to providing a 'reasonable care and due diligence' defence, Regulation 49 also provides for a number of licensing regimes. Conditions, restrictions, limitations or requirements associated with such licences will, naturally, impact how one manages IAPS.

3.2.4.2.1 Licensing under Regulation 49(7)

Regulation 49(2) provides that '*Save in accordance with a licence granted under paragraph (7), any person who plants, disperses, allows or causes to disperse, spreads or otherwise causes to grow* [Emphasis added]' Japanese knotweed (Fallopia japonica) and other scheduled IAPS[86] shall be guilty of an offence.[87]

Regulation 49(7) of the European Communities (Birds and Natural Habitats) Regulations, 2011,[88] provides for the regulation of such licensing, with Regulation 49(7)(f) notably providing that '*A licence*

[83] Part 1 of the Third Schedule to the European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No. 477 of 2011)

[84] Regulation 49(2) of the European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No. 477 of 2011)

[85] Regulation 49(3) of the European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No. 477 of 2011)

[86] Part 1 of the Third Schedule to the European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No. 477 of 2011)

[87] Regulation 49(2) of the European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No. 477 of 2011)

[88] Regulation 49(7) of the European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No. 477 of 2011)

granted under this paragraph shall be subject to such conditions, restrictions, limitations or requirements as the Minister considers appropriate.'[89] Whilst a number of queries have been raised as to whether or not such a licence is required by those seeking to manage Japanese and other scheduled IAPS, it is generally considered prudent to do so. It is clear that the imposition of 'conditions, restrictions, limitations or requirements' by the Minister for Culture, Heritage and the Gaeltacht has the potential to alter how such management is to be carried out.

3.2.4.2.2 Licensing under Regulation 49(13)

Section 40(1) of the Wildlife Act, 1976,[90] as amended, states:

> *(a) It shall be an offence for a person to cut, grub, burn or otherwise destroy, during the period beginning on the 1st day of March and ending on the 31st day of August in any year, any vegetation growing on any land not then cultivated.*
>
> *(b) It shall be an offence for a person to cut, grub, burn or otherwise destroy any vegetation growing in any hedge or ditch during the period mentioned in paragraph (a) of this subsection.*

As Section 40(1) makes it an offence (subject to exceptions) to destroy vegetation during the bird nesting season, this section had the potential to create difficulties for those wishing to manage IAPS during this period. However, Regulation 49(13)(a) provides that '*Where the Minister considers* [...] *that a species of flora or a type of vegetation poses a threat to any of the objectives of the Birds and Habitats Directives* [...] *the Minister may, notwithstanding anything contained in Section 40 of the Wildlife Act 1976 , grant a licence for the destruction, by such means as the Minister may specify, of vegetation comprising or containing that species at any time including, where he or she considers it warranted, during the period from 1 March to 31 August*.'[91] Those wishing to manage IAPS during the bird nesting season may need to seek a licence under Regulation 49(13).

[89] Regulation 49(7)(f) of the European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No. 477 of 2011)

[90] Section 40(1) of the Wildlife Act, 1976, as substituted by Section 46(a) of the Wildlife (Amendment) Act, 2000

[91] Regulation 49(13) of the European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No. 477 of 2011), as inserted by Regulation 12 of the European Communities (Birds and Natural Habitats) (Amendment) Regulations, 2015 (S.I. No. 355 of 2015)

3.2.4.2.3 Licensing under Regulation 49(14)

Another relatively recent insertion to the Habitats Regulations is Regulation 49(14).[92] Regulation 49(14)(a) states '*An application for a licence under this paragraph shall be determined in accordance with Regulation 42 and, where appropriate, Regulation 43*',[93] where Regulations 42 and 43 transpose Articles 6(3) and 6(4) of the Habitats Directive and relate to Appropriate Assessment, etc.[94] Regulation 49(14)(b) states:

> *(b) A licence granted under this paragraph may give general authorisation for the destruction of vegetation comprising or containing the species of flora that the Minister considers poses a threat to the objectives of the Birds Directive or the Habitats Directive or of both—*
>
> *(i) in any place where it may be found,*
>
> *(ii) in any specified region, district or place, and*
>
> *(iii) in any specified situation or circumstances.*[95]

Therefore, where the Minister considers that the vegetation poses a threat to the objectives of the Birds and/or Habitats Directives, he/she may give general authorisation for the destruction of this vegetation.

Regulation 49(14)(c) indicates that the Minister may specify conditions, limitations or restrictions in such a licence,[96] with Regulation 49(14)(d) providing that failure to comply with such conditions, limitations or restrictions is an offence,[97] with potentially serious penalties.[98]

[92] Regulation 49(14) of the European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No. 477 of 2011), as inserted by Regulation 12 of the European Communities (Birds and Natural Habitats) (Amendment) Regulations, 2015 (S.I. No. 355 of 2015)

[93] Regulation 49(14)(a) of the European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No. 477 of 2011), as inserted by Regulation 12 of the European Communities (Birds and Natural Habitats) (Amendment) Regulations, 2015 (S.I. No. 355 of 2015)

[94] Articles 6(3) and 6(4) of Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora [1002] OJ L206/7

[95] Regulation 49(14)(b) of the European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No. 477 of 2011), as inserted by Regulation 12 of the European Communities (Birds and Natural Habitats) (Amendment) Regulations, 2015 (S.I. No. 355 of 2015)

[96] Regulation 49(14)(c) of the European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No. 477 of 2011), as inserted by Regulation 12 of the European Communities (Birds and Natural Habitats) (Amendment) Regulations, 2015 (S.I. No. 355 of 2015)

[97] Regulation 49(14)(d) of the European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No. 477 of 2011), as inserted by Regulation 12 of the European Communities (Birds and Natural Habitats) (Amendment) Regulations, 2015 (S.I. No. 355 of 2015)

[98] Regulation 67(2) of the European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No. 477 of 2011), as amended by Regulation 13 of the European Communities (Birds and Natural Habitats) (Amendment) Regulations, 2015 (S.I. No. 355 of 2015)

4. Key Control Strategies of Invasive Alien Plant Species during Planning, Construction and Maintenance of National Roads

This Section provides an overview of the key control strategies that must be incorporated into the planning, construction practices and maintenance regimes of national roads.

4.1 Planning

As previously stated in Section 2.1, the early identification and management of IAPS can significantly reduce the resources required to minimise the spread of these species (refer to Figure 2). Enabling works or advance contracts are the most efficient and cost effective preferable way of removing IAPS from a site to minimise impacts on the main contract works. Ideally, this requirement should be identified and planned for at Phase 3 (Design and Environmental Evaluation) and Phase 4 (Statutory Processes) as per Section 3.3 of PE-PMG-02041 *Project Management Guidelines* (TII).

As part of the Environmental Impact Assessment (EIA) process for the planning of a proposed new national road project or during the planning phase of any road development or improvement works, the presence and abundance of IAPS must be documented as part of the general species composition data recorded. Suitable qualified personnel (see, for reference, the requirements *vis-à-vis* ecologists, geographical information systems technicians and land surveyors contained within Appendix A), with experience in identifying IAPS in all growth phases, should undertake the assessment. This assessment will provide data on the species present, scale of infestation and physical site conditions that will inform the most appropriate control and management measures. It should also record any previous attempts at control or eradication, detailing the success or failure of the measures applied, if known. This data will facilitate the development of a systematic control programme, which, due to the invasive nature of IAPS, may require a long-term commitment. This requirement in terms of planning and resources (to be identified at Phases 3 and 4) needs to be accommodated within the contractual and management arrangements for the development works during Phases 5 (Enabling and Procurement) and 6 (Construction and Implementation), as per TII's *Project Management Guidelines*. This may require the compulsory purchase of lands under, for example, a Compulsory Purchase Order (CPO) or the temporary acquisition of lands beyond the lands made available/permanent landtake of the works in order to manage any IAPS infestations present.

GE-ENV-01104 outlines the systematic approach of IAPS management to be followed during the planning of any national road development works.

4.2 Construction

Areas identified as requiring specific IAPS treatment during the planning phase of any proposed national road development works should be demarcated and the designated control measures implemented at the earliest possible stage to reduce the risk of spread of IAPS by means of enabling or advance works.

During the construction of any road development or improvement works, raw materials (e.g. rock, topsoil, sands and gravel) may be imported from a range of locations. It is important that all such locations, (e.g. quarries, gravel pits, or other areas) are assessed for the presence of IAPS in advance of removing any material from such sites.

At sites where IAPS that reproduce solely using seeds are known to be present, priority should be given to reducing the risk of seed transfer by preventing the plants from flowering.

In relation to all IAPS efforts should be made to reduce the risk of material transfer by instigating appropriate controls on the movement of machinery and soil/gravel/stones in the infected area, i.e. by implementing strict and appropriate biosecurity measures on site. Biosecurity essentially refers to the measures to be taken to prevent the introduction and spread of IAS; refer to GE-ENV-01104.

A systematic approach should be taken in the removal and control of IAPS, ensuring that the use of tracked machinery is limited in infested areas and vehicles and equipment are cleaned before moving between sites. This will minimize the risk of introducing or reintroducing contaminated soil/gravel/stones, seeds or plant fragments into areas that is already treated or developed.

The management strategy for IAPS presented in GE-ENV-01104 provides the template for strategic management, which should commence with an assessment of the detailed distribution of all IAPS within the lands in question. Following this, the approach to control and preventing the further spread of the plant can be elaborated depending on the following:

- The scale and extent of infestation (including whether confined to the road footprint or not)
- The IAPS present
- The sensitivity of the local environment, e.g. presence of Natura 2000 sites or natural heritage areas
- The growth stage/season of the plants

Care should be taken to choose the most appropriate control method for the specific circumstances of each site. As outlined in Section 3.2.1, chemical control of IAPS may risk damaging adjacent rare or protected flora and fauna in sites of special conservation interest or in adjacent waterbodies. Where an infestation occurs in lands adjacent to the road scheme, control along the road verges may prove ineffective due to the potential for recolonization of IAPS from these adjoining lands.

Control of IAPS on national road schemes during the construction phase requires adherence to an appropriate and effective soil management plan (refer to Section 5.5 of GE-ENV-01102 *A Guide to Landscape Treatments for National Road Schemes in Ireland* (TII)). Where the presence of IAPS go unchecked, contamination of soil stores can occur, which can result in the unintentional spread of IAPS over a wide area during spreading and final shaping of soils, in preparation for landscape treatments. In circumstances where soils/gravel/stones are imported from outside the CPO lands, appropriate pre-construction surveys should be carried out to determine the presence of IAPS at the site of extraction. If IAPS are present at the site of extraction, soil should not be imported from this location due to the risk of introducing these species to the works area. The areas of infestation and the appropriate buffer zone must be isolated with fencing or warning tape and ‘biosecure zone’ signs must be erected at each contaminated area to alert workers to the presence of IAPS and to ensure that they avoid entering or unnecessarily interfering with these sites.

GE-ENV-01104 outlines the systematic approach of IAPS management to be followed during the construction phase of any national road development works.

4.3 Maintenance

Roadsides are important dispersal corridors for many plants, including IAPS. Those responsible for the maintenance regimes of roadsides must be cognisant of the risks of liability associated with the spreading of IAPS (refer to Section 3). Road verges are regularly mown for traffic-safety reasons. Hedge cutting and strimming pose a significant risk by facilitating the spread of IAPS along road verges. Local authorities and maintenance contractors must remain vigilant in their management of road verges to prevent the establishment and spread of IAPS and to protect native biodiversity.

TII, in collaboration with the Kildare National Roads Office (NRO), have produced signage to deter hedge cutters from cutting in areas contaminated by Japanese knotweed (Figure 3) and where the management of Japanese knotweed is currently being undertaken. This signage can be adapted to warn of other IAPS along roadsides, as appropriate. A flier has also been produced to warn those engaging in roadside management to refrain from carrying out any hedge cutting or strimming activities in areas contaminated by Japanese knotweed (Figure 4).

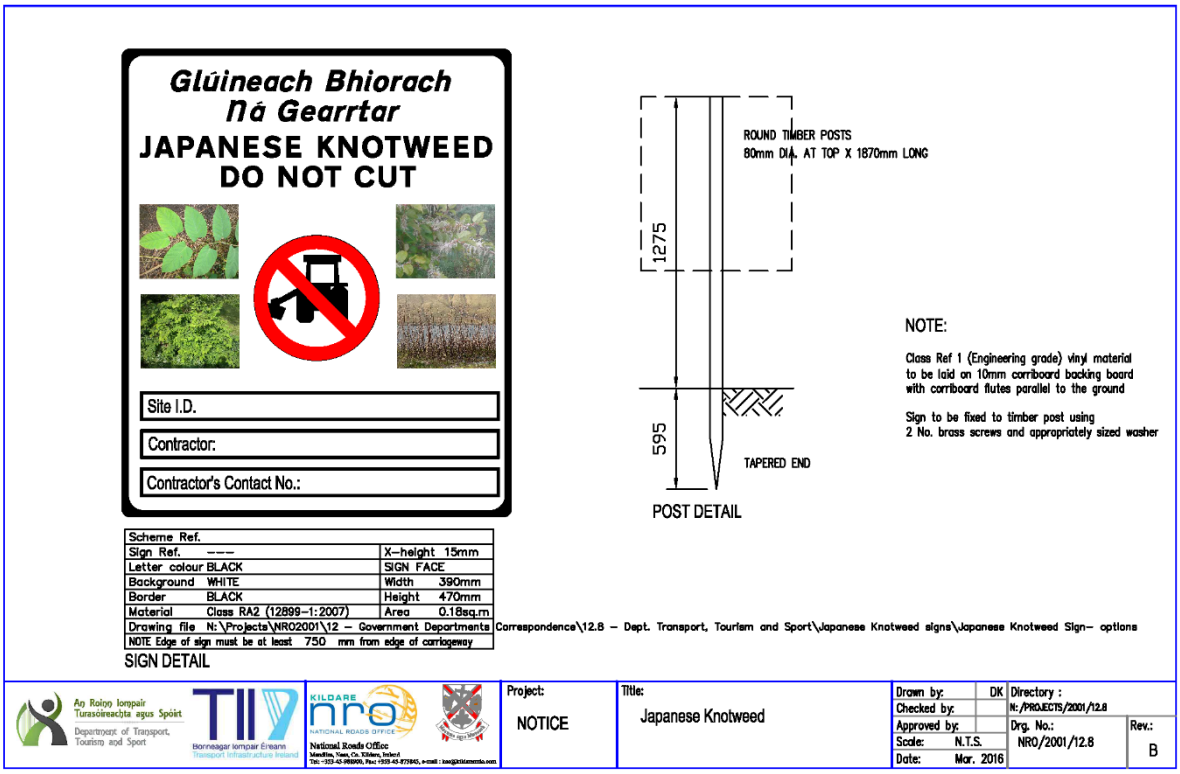

Figure 3 Design specification for signage to deter any hedge cutting or strimming activity in areas contaminated by Japanese knotweed

Figure 4 Flier to deter any hedge cutting or strimming activity in areas contaminated by Japanese knotweed

The approach to IAPS control and the specific requirements *vis-à-vis* health and safety will vary according to the location of the infestation (e.g. embankments, verges, medians, interchanges). National road cross-sections vary considerably. For example, the current standard Type 1 Dual Carriageway (D2AP) cross-section generally includes an embankment (where in cut or fill), a 2.0m grass verge adjacent to the hard shoulder and a hard central reserve with a concrete median barrier. Older standard cross sections typically contained wide grassed medians to which wire-rope crash barriers were generally retro-fitted.

Grade-separated junctions will generally incorporate roundabouts and will generally have a combination of grassland and landscape planting with fringing crash barriers. Suitably qualified personnel (refer to Appendix A) must be employed when undertaking IAPS management during maintenance activities.

Traditionally, the central reserves of Irish motorways and dual carriageways have been grassed and, consequently, can be subject to infestation by IAPS. Treatment of these IAPS in the central reserve is complicated by the presence of wire rope and/or other barriers and anti-dazzle screens. More recent construction, however, has incorporated a paved narrow median, which somewhat reduces the risk of IAPS infestations. Grade-separated junctions may incorporate roundabouts and crash barriers, and will generally have a combination of grassland and landscape planting.

For the treatment of IAPS, road verges may be accessed from the road carriageway or the hard shoulder. Temporary Traffic Management (TTM) for road verge treatment is likely to be more onerous in the absence of a hard shoulder (refer to Appendix A for the qualifications required by personnel involved in IAPS (TTM) works). The standard road cross section will include sections of cut and fill, with side slopes. Difficulties with access will, in many situations, preclude the use of machinery to treat IAPS on cut and fill slopes.

In all situations, a risk assessment shall be undertaken to identify the hazards at the particular site and to facilitate planning of the IAPS control and Temporary Traffic Management design, in accordance with the HSA Guidelines for Working on Roads *Guidelines for Works on Roads* (Health and Safety Authority, 2009) and the *Temporary Traffic Management Design Guidance* (Department of Transport, 2019). All signing, lighting and guarding at the works must be supervised by a competent person (refer to Appendix A).

GE-ENV-01104 outlines the systematic approach of IAPS management to be followed during the maintenance regimes of any national roads where IAPS have been identified.

4.3.1 Soil/Scree Slopes and Embankments

Side slopes on roads will vary in height according to the extent of cut or fill. Chemical control on standard side slopes can be undertaken using hand-operated lances fed from a vehicle-mounted bowser. It is important to ensure that such treatments are targeted and every effort made to avoid chemical spread onto non-target plants or plant stands. The vehicle will be able to operate within the hard shoulder. Where infestation levels are low (i.e. 10% or less plant cover), use of knapsack sprayers may be more efficient.

Where control is required on slopes greater than 2:1, specific measures may be required to facilitate access. Such slopes are normally rock-cuttings or rock faces. Some rock faces can be inaccessible and can support the growth of IAPS such as Buddleia (*Buddleja davidii*) and Rhododendron.

The use of machinery on such steep slopes is typically not an option and physical control methods or herbicide application may require the use of self-arrest or belay systems by personnel. In areas of rock cutting where the surface is uneven and the potential for loose rock is present, an anchored tender should belay the operator from the top of the slope. The belay equipment required is similar to that used in tree surgery, with the operator wearing a harness to which is attached a static rope.

As abseiling requires the operator to control their own descent, this does not leave them with both hands free to operate a knapsack sprayer or weed wiper.

On steep uniform slopes that are under grass or trees and shrubs, spiked boots or fitted crampons will enable the operator to traverse the slope with greater control than in standard working footwear. The requirement for a belay in such situations will depend on the characteristics of the site.

4.3.2 Central Reserves or Medians

The configuration of barriers, landscaping and the width of the central reserve or median, in conjunction with the scale of the IAPS infestation, will dictate what type of control measure is most appropriate in the central reserve. Physical control by cutting, topping or pulling may be undertaken using hand-operated machinery or hand tools. Chemical control in central reserves may be undertaken using vehicle-mounted or knapsack sprayers or weed wipes.

4.3.3 Grade-separated Junctions or Interchanges

As with central reserves or medians, the configuration of barriers, landscaping and the scale of the IAPS infestation will determine the approach to be adopted to control at grade-separated junctions or interchanges. A similar approach to that adopted for central reserves or medians is recommended.

4.3.4 Immediate and Wider Verge Areas

In certain cases, regular mowing of verges as part of the standard road maintenance programme may ensure that weeds are unlikely to be a problem because mowing keeps the plants in check and prevents flowering/seeding. However, prior to the undertaking of any mowing activities on the immediate and wider verge areas, it is important to ensure that no IAPS are present in the area.

The requirement for lane closures should be risk assessed, based on the site, and appropriate Temporary Traffic Management Plan (TTMP) using advance warning signage or vehicles as appropriate.

5. Invasive Alien Plant Species Management and Control

Any planning, development or maintenance works on national roads must take into account the risks associated with IAPS infestations. An assessment of the presence and status of IAPS must be undertaken to guide the selection of control measures and the appropriate risk management requirements. The control of IAPS should be undertaken in four distinct phases (Figure 5), as follows:

- Phase 1: Undertake a detailed site assessment and risk assessment
- Phase 2: Create a detailed IAPS Management Plan
- Phase 3: Implement biosecurity and the appropriate control methods
- Phase 4: Undertake post control monitoring

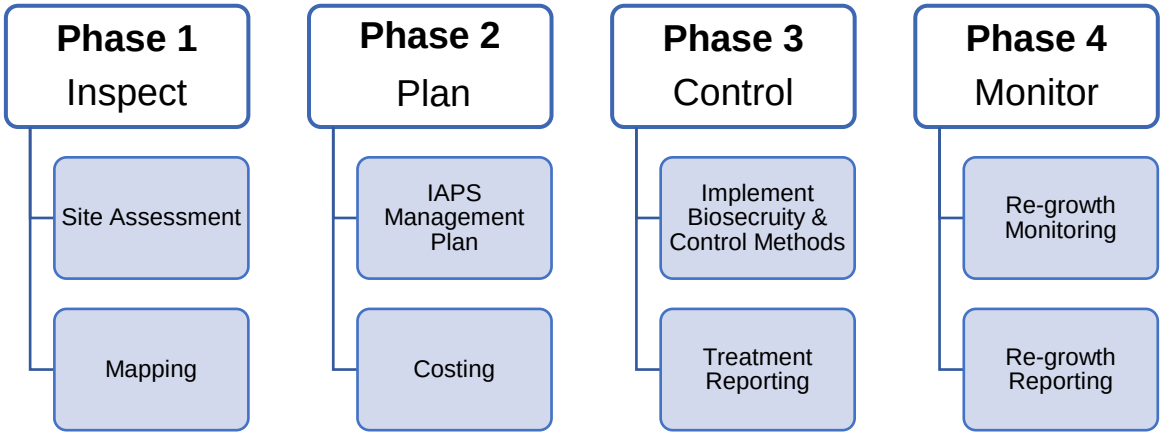

Figure 5 Infographic outlining the different phases associated with any IAPS management process

This protocol may be applied to any IAPS within all ecosystems. The information gathered will act as a source of information for IAPS inventories, planning, analysis, monitoring, treatment, reporting and resource allocation.

In any construction project, a clerk of works will oversee the implementation of any IAPS control works. Everyone working on the site must clearly understand the role and authority of the clerk of works.

Details of the activities to be carried out at each Phase are provided in GE-ENV-01104.

5.1 Phase 1: Invasive Alien Plant Species Site Inspection

Details of the activities to be carried out at Phase 1 are provided in GE-ENV-01104.

In circumstances where designated conservation areas (including Natura 2000 sites, Natural Heritage Areas, proposed Natural Heritage Areas, Nature Reserves and National Parks and others) adjoin the roadside, local authorities are advised to consult with the local National Parks and Wildlife Service (NPWS) Ranger in advance of undertaking any controls in such areas.

5.2 Phase 2: IAPS Management Planning and Costing

Details of the activities to be carried out at Phase 2 are provided in GE-ENV-01104.

Where infestations extend outside of the road footprint, the risk for re-infestation following control is high and this should be planned for at Phase 5 (Enabling and Procurement, Section 3.3 of PE-PMG-02041 *Project Management Guidelines* (TII)). This may require the temporary acquisition of land outside the permanent landtake to prevent the risk of re-infestation.

The potential risks associated with the future spread of identified IAPS may need to include the potential for re-infestation of the treated/developed road margin from adjacent lands and how activities undertaken during the project could spread IAPS to adjacent areas or along the proposed route.

5.3 Phase 3: Invasive Alien Plant Species Control Methods

Details of the activities to be carried out at Phase 3 are provided in GE-ENV-01104.

5.4 Phase 4: Invasive Alien Plant Species Treatment Monitoring

Details of the activities to be carried out during treatment monitoring are provided in GE-ENV-01104.

6. Invasive Alien Plant Species – Identification, Ecology and Control

There are a significant number of IAPS present in Ireland and it was not possible, nor appropriate, to include detailed information for all of them in this guidance document. The species selected for inclusion are those that have been shown to have an adverse impact on landscape quality, native biodiversity or infrastructure, and are likely to be encountered on proposed or existing national roads. These are:

- Japanese knotweed (*Fallopia japonica*) (Section 6.1)
- Giant knotweed (*Fallopia sachalinensis*) and Bohemian knotweed (*Fallopia x bohemica*) (Section 6.2)
- Himalayan knotweed (*Persicaria wallichii*) (Section 6.3)
- Giant hogweed (*Heracleum mantegazzianum*) (Section 6.4)
- Indian or Himalayan balsam (*Impatiens glandulifera*) (Section 6.5)
- Giant rhubarb (*Gunnera tinctoria*) (Section 6.6)
- Montbretia (*Crocosmia x crocosmiiflora*) (Section 6.7)
- Winter heliotrope (*Petasites fragrans*) (Section 6.8)
- Old man's beard (*Clematis vitalba*) (Section 6.9)
- Rhododendron (*Rhododendron ponticum*) (Section 6.10)
- Buddleia (*Buddleja davidii*) (Section 6.11)

Information on the identification, ecology and control options for the species listed is presented in the following sections.

There are a number of other IAPS that either have been encountered to a lesser extent, or it is anticipated may be encountered in the future, on proposed or existing national roads. These species, which are dealt with in summary detail in Section 6.12, are as follows:

- Himalayan honeysuckle *(Leyesteria formosa*) (Section 6.12.1)
- Russian vine (*Fallopia baldschuanica*) (Section 6.12.2)
- Spanish bluebell (*Hyacinthoides hispanica*) (Section 6.12.3)
- Three-cornered leek (*Allium triquetrum*) (Section 6.12.4)

6.1 Japanese knotweed (*Fallopia japonica*)

It is recommended that readers refer to the Property Care Association's (2014) *A guide to the problems caused by Japanese knotweed and how to deal with them,* the Environment Agency's (2016) *Guidance – Prevent Japanese knotweed from spreading*, the Welsh Government's (2011) *The Control of Japanese knotweed* (Fallopia japonica) *in Construction and Landscape Contracts – Model Specification and Guide to Procurement* and the Jones *et al.* (2018) publication *Optimising physio-chemical control of invasive Japanese knotweed* when dealing with Japanese knotweed related issues.

6.1.1 Ecology and Distribution

Japanese knotweed is a member of the Polygonaceae (docks and rhubarb family), native to Japan and northern China. It has, however, become widely distributed throughout Europe, North America, Canada, New Zealand and Australia. It is an herbaceous, perennial plant that is subject to some taxonomic confusion due to a combination of numerous synonyms and its capacity for hybridization with closely related species (refer to Section 6.2, which deals with Giant and Bohemian knotweed species).

The species was first recorded growing wild in the south of Ireland in 1902 (Reynolds, 2002), although it had probably been intentionally introduced to the country as an ornamental or to provide ground cover long before this date. Japanese knotweed produces vigorous stands on rural and urban waste ground, in the riparian zones of rivers, along roadsides and even on coastal islands. It can grow through loose block-work and damage riverbank protection works, tarmacadam and paving (Welsh Government, 2011).

Japanese knotweed causes significant problems due to its prolific and dense growth habit. These include blocking sight-lines on roads, damage to paving and structures (Figure 6), erosion of river banks and damage to flood defence structures, damage to archaeological sites, and loss and displacement of native habitats and species.

Figure 6 Young Japanese knotweed plants growing through a gravel surface

Only female plants have been recorded in Ireland and, while seeds are produced, these are rarely viable. Indeed, the entire population in Ireland appears to be a single female clone (Montgomery, n.d.). The majority of the rhizome system is confined to the top metre of soil, reflecting the fact that the rhizome is an underground stem rather than a root and will spread laterally in preference to achieving depth. Japanese knotweed rhizomes have an extremely high regenerative potential and greenhouse trials have shown that as little as 0.7 gram of rhizome material (10mm in length) can produce a new plant within 10 days. Rhizome material may remain dormant for long periods, possibly as long as 20 years, and may regrow when disturbed. Cut fresh stems will produce shoots and roots from nodes when buried in soil or immersed in water. Once cut stem material has been allowed to dry thoroughly and has reached the orange/brown ‘woody’ stage (Figure 7), it is not capable of further regeneration. Dispersal typically occurs through rhizome fragments being transported in soil by humans or, to a lesser extent, through passive mechanical means such as in floodwaters.

Dispersal is also achieved through vegetative reproduction from stem fragments. Japanese knotweed is widespread throughout Ireland and is spreading rapidly (Figure 8).

Figure 7 Japanese knotweed rhizomes

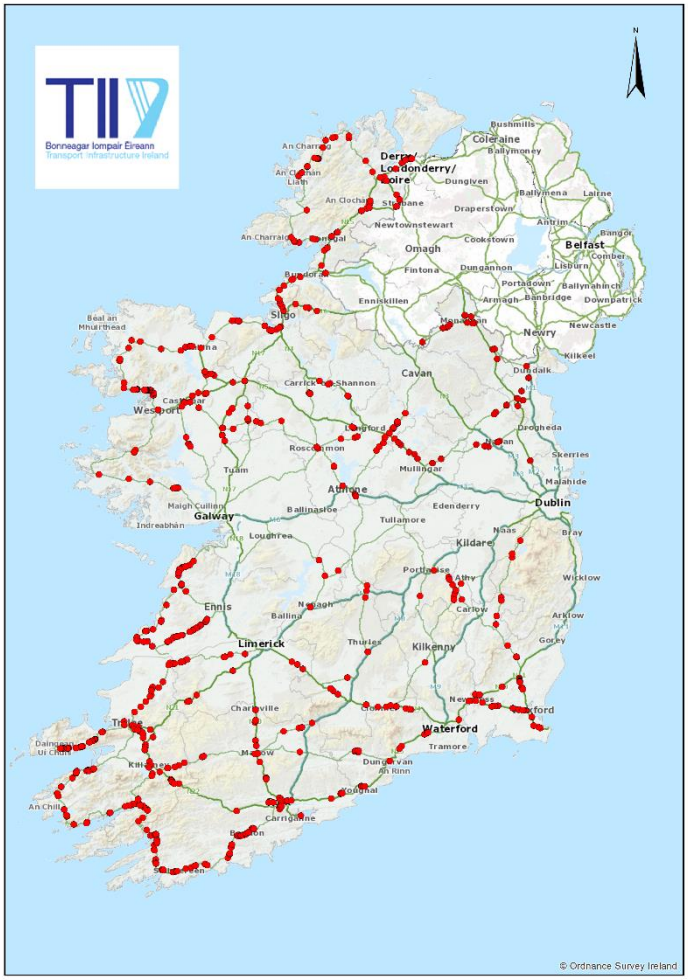

Figure 8 Distribution of Japanese knotweed along the national road network, Ireland, updated in 2018

6.1.2 Identification

The following provides a brief summary of the defining characteristics of Japanese knotweed:

- It is a fast-growing, robust, perennial plant that rapidly produces dense and extensive vegetation stands. In spring, the plant produces new shoots from rhizome buds on a dense underground crown. These shoots are green, tinged with red/purple and have distinctively rolled leaves; they can appear asparagus-like. As the shoots grow, they extend to produce upright, hollow, bamboo-like green stems, covered in red/purple speckles. The stems can grow to 3m high and achieve a diameter of 40mm in a single season
- The leaves of the mature plant are bright green, heart-shaped, up to 170mm in length with a flattened (truncate) base and pointed tip, and are arranged in a characteristic zig-zag pattern. Close examination reveals no or few hairs on the midrib or lateral veins on the underside of Japanese knotweed leaves (Giant and Bohemian knotweeds have long and short hairs, respectively, on the veins on the underside of the leaves; refer to Section 6.2)
- In winter, following leaf die-back, the upright shoots turn deep red or straw-coloured and form characteristic clumps of hollow canes that can remaining standing long into the following season (Figure 9)
- The plant flowers between August and October, producing clusters of small creamy-white flowers (Figure 10) from the leaf axils (point at which the leaf joins the stem). The flowers occasionally produce dark brown seeds within three-winged seed capsules
- The rhizomes or underground stems are thick (from 5–100mm diameter) and fleshy to woody. The bark of the rhizome is dark brown and the texture is leathery. The nodes along the rhizome are often enlarged and impart a knotty appearance to the rhizome. Small white roots commonly emerge from these nodes. Beneath the bark, the rhizome is bright orange or carrot-coloured. The rhizome system of large plant stands is extensive (extending 15–20m in length) and acts as a storage organ, allowing for rapid growth in spring

Figure 9 Dead Japanese knotweed stems or canes in winter

Figure 10 Japanese knotweed - Flowers and Foliage

6.1.3 Control

The control or management of any IAPS should be undertaken in the four distinct phases, outlined in GE-ENV-01104. It is recommended that a suitably qualified ecologist or horticulturalist with sufficient training, experience and knowledge in the control of IAPS should be employed to assist in the planning and execution of control measures in relation to Japanese knotweed. In addition, it is recommended that those involved in the control of Japanese knotweed have access, where appropriate, to the advice of a Registered Pesticide Advisor on the register established by the Minister for Agriculture, Food and the Marine pursuant to Regulation 4 of the Sustainable Use of Pesticides Regulations. All pesticide users must be registered and have the appropriate training necessary to carry out the proposed method of control.

Due to the highly invasive nature of the plant species, Japanese knotweed control has been the subject of considerable research and investigation (Jones, et al., 2018). The primary objective of control should be eradication by targeting the underground rhizome and not simply the aerial parts. It should be noted that none of the methods outlined in the following sections guarantee eradication.

Japanese knotweed is highly invasive and extremely difficult to eradicate completely. All control measures will require follow-up treatments to minimise the possibility of rhizome regrowth, which should be undertaken for a minimum of three growing seasons (and up to four growing seasons) after control.

The approach to control will depend on several factors including the scale of the infestation, the topography and terrain of the site, the proximity to watercourses or other sensitive receptors (such as protected flora), the funds available, among others. Control measures that are currently available are limited to physical, chemical and a combination of both, although biological control using predators and pathogens from the plant’s native range is being actively researched. However, according to current research, it appears that biological control agents will only stunt the plant's growth and that conventional control measures will have to be used alongside biological controls.

In the case of Japanese knotweed, physical methods, on their own, are unlikely to eradicate Japanese knotweed infestations. In all cases, chemical treatment, either on its own or in combination with physical treatment, will be required.

As highlighted in GE-ENV-01104, it is vital to accurately map the detailed distribution of all IAPS. This is particularly important when managing Japanese knotweed as areas of infestation can extend 7m horizontally (and up to 2m in depth) from the nearest above-ground plant. When managing areas infested with Japanese knotweed, the management phases outlined in Figure 5 must be followed.

6.1.3.1 Chemical control

While a number of chemicals are effective in controlling Japanese knotweed, many of these are undesirable due to their non-selective nature, persistence or toxicity to aquatic ecosystems. Care is required in the selection of the appropriate PPP and method of application. In making this selection, regard should be had to the abundance of Japanese knotweed, the location of the stand, the proximity and nature of sensitive receptors, and the season. Only certain PPPs are approved for use in or near water. Not all PPPs are selective in nature and the persistency of PPPs varies. The method of application should be as targeted as possible, having regard to all other factors. PPPs must be used in compliance with the product label and in accordance with the legislation regulating their use and the sustainable use of pesticides. With all forms of chemical control in relation to Japanese knotweed, follow-up treatment will be required in subsequent years.

The current most widely recommended active ingredient for Japanese knotweed control is glyphosate, which breaks down in the soil relatively quickly. Glyphosate is a broad spectrum herbicide and, as such, is potentially damaging to non-target plants. Great care is, therefore, necessary when applying this herbicide and it may be appropriate to seek advice from a Registered Pesticide Advisor. A recent study has demonstrated that effective control of Japanese knotweed may be achieved by biannual (summer and autumn) foliar glyphosate applications or by annual application of glyphosate in autumn (after the flowering period but prior to senescence) using stem injection (at high concentrations) or foliar spray (Jones, et al., 2018).

Selective herbicides containing the active ingredients aminopyralid and fluroxypyr are increasingly being used to chemically control Japanese knotweed. However, these products are toxic to aquatic life and must not be used in or near water. They also cannot be used on land that will be grazed by livestock. Aminopyralid and fluroxypyr have a low to moderate persistence in soil (this can be up to 35 days in the case of aminopyralid). Products containing these active ingredients should not be used on or adjacent to soil that may be used as garden top-soil, for potting or used on grass that may be cut and used as mulch or for compost for horticultural or garden crops.

Products containing the active ingredients aminopyralid and triclopyr are also increasingly being trialled in Japanese knotweed control. Products containing these active ingredients are selective, but they are highly toxic to aquatic life and deemed slightly toxic to birds, on an acute basis. These herbicides are more persistent, with an average persistency of ≤ six weeks. Products containing these active ingredients should not be used on or adjacent to soil that may be used as garden top-soil, for potting or used on grass that may be cut and used as mulch or for compost for horticultural or garden crops.

6.1.3.2 Physical control

Where feasible, preference should be given to treating Japanese knotweed in its original location to limit the risk of further spread of the plant. A number of physical control methods have been developed to deal with Japanese knotweed, which are all based on the mechanical excavation of the rhizome material and its subsequent containment either at depth, within an impermeable membrane, or its disposal off-site. Sections 2.3.2 and 2.3.3 of GE-ENV-01104 The Management of Invasive Alien Planet Species on National Roads – Standard outline the appropriate physical methods of excavation, disposal and biosecurity measures that should be followed when physical control of Japanese knotweed is conducted.

6.2 Giant knotweed (*Fallopia sachalinensis*) and Bohemian knotweed (*Fallopia x bohemica*)

6.2.1 Ecology and Distribution

Giant knotweed is a member of the Polygonaceae (docks and rhubarb family), native to Japan and Sakhalin Island, Russia. It is a tall (up to 5m), herbaceous perennial with green, bamboo-like stems that forms dense patches, which exclude native plant species, thereby reducing native biodiversity. The leaves of Giant knotweed are cordate (i.e. notched or indented at the base) and can grow up to 40cm in length. Giant knotweed is relatively widespread in Ireland but is not found to the same extent along roadsides as Japanese knotweed (Figure 11).

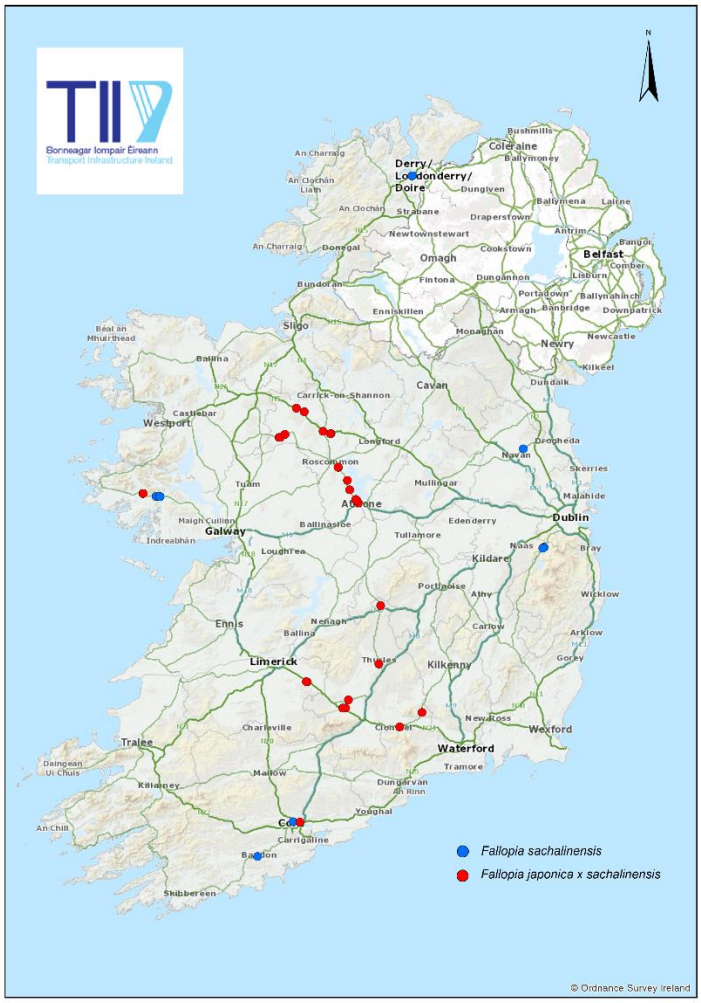

Figure 11 Distribution of Giant knotweed and Bohemian knotweed along the national road network in Ireland

A hybrid between Japanese knotweed and Giant knotweed also occurs, which is Bohemian knotweed. This species has, at the moment, a limited distribution in Ireland (Figure 11). It is unclear whether this is due to it commonly being misidentified as one of its parents. The hybrid is a particularly large plant, up to 4m tall, with hollow bamboo-like red/purple mottled stems and its inflorescences are similar to either of its parent plants. Its leaves are smaller than Giant knotweed but larger than Japanese knotweed, at up to 20cm long. Unlike its parents, Bohemian knotweed is reputed to be capable of producing viable seed in the UK and Ireland, although germination and establishment is a rare occurrence (Pashley, et al., 2003).

6.2.2 Control

The control or management of any IAPS should be undertaken in the four distinct phases outlined in GE-ENV-01104. It is recommended that a suitably qualified ecologist or horticulturalist with sufficient training, experience and knowledge in the control of IAPS should be employed to assist in the planning and execution of control measures in relation to Giant knotweed and Bohemian knotweed. In addition, those involved in the control of Giant knotweed and Bohemian knotweed may be advised to have access to the advice of a Registered Pesticide Advisor on the register established by the Minister for Agriculture, Food and the Marine pursuant to Regulation 4 of the Sustainable Use of Pesticides Regulations. All pesticide users must be registered and have the appropriate training necessary to carry out the proposed method of control.

Similar to Japanese knotweed, Giant knotweed and Bohemian knotweed are most commonly spread by rhizomes and eradication of these species is equally as difficult (refer to Japanese knotweed control in Section 6.1.3). The root system of the hybrid can extend 15–20m in length and acts as a storage organ, allowing for rapid growth in spring.

6.3 Himalayan knotweed (*Persicaria wallichii* or *Polygonum polystachium*)

6.3.1 Ecology and Distribution

Himalayan knotweed is a member of the Polygonaceae (docks and rhubarb family), native to the Himalayas and the western temperate regions of Asia. It is an herbaceous perennial that rarely exceeds 1.5m in height. Similar to the other knotweed species detailed in Sections 6.1 and 6.2, Himalayan knotweed grows vigorously and creates dense, widespread stands that exclude native vegetation. It is most likely an escapee from cultivation that is established widely (Figure 12) on roadsides in Ireland (Figure 13) (Reynolds, 2002).

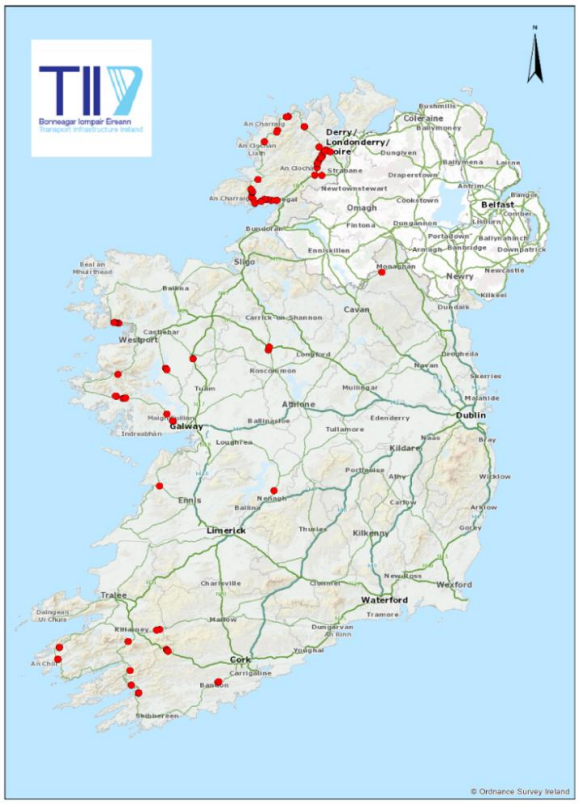

Figure 12 Distribution of Himalayan knotweed along the national road network in Ireland

6.3.2 Identification

The following provides a brief summary of the defining characteristics of Himalayan knotweed:

- Its leaves are lanceolate, cordate (notched or indented at the base), with entire margins, a red midrib and pointed tip. A brown sheath persists at the base of the leaf stalk
- Its bamboo-like stems are circular, typically green but may also have a red/green coloration and are almost solid in cross-section
- It produces small white or pink flowers that are loosely clustered
- It flowers in late summer to early autumn and dies back in the winter, leaving stands of dead brown canes
- It has an extensive underground rhizome system
- Dispersal typically occurs through rhizome fragments or vegetative reproduction from plant fragments

Figure 13 Himalayan knotweed - Plant

6.3.3 Control

The control or management of any IAPS should be undertaken in the four distinct phases outlined in GE-ENV-01104. It is recommended that a suitably qualified ecologist or horticulturalist with sufficient training, experience and knowledge in the control of IAPS should be employed to assist in the planning and execution of control measures in relation to Himalayan knotweed. In addition, those involved in the control of Himalayan knotweed may be advised to have access to the advice of a Registered Pesticide Advisor on the register established by the Minister for Agriculture, Food and the Marine pursuant to Regulation 4 of the Sustainable Use of Pesticides Regulations. All pesticide users must be registered and have the appropriate training necessary to carry out the proposed method of control.

Similar to Japanese knotweed, Himalayan knotweed is most often spread by rhizomes and eradication of this species is equally as difficult (refer to Japanese knotweed control in Section 6.1.3).

6.4 Giant hogweed (*Heracleum mantegazzianum*)

6.4.1 Ecology and Distribution

Giant hogweed is a member of the carrot family (Apiaceae) and bears a close resemblance to the native and widespread Common hogweed (*Heracleum sphondylium*) or Wild angelica (*Angelica sylvestris)*, although these species are rarely more than 1.5m tall. Giant hogweed is native to the Caucasus Mountains in south-west Asia. It is highly invasive due to its vigorous early-season growth, tolerance of shade and flooding, and its efficient production and dispersal of seeds. Individual plants live for 3–5 years, after which they set seed and die. They spread solely by seed, producing several thousand seeds per flower head. These seeds can be dispersed over short distances by wind, but they can be spread over considerably longer distances by rivers, streams, machinery and any movement of contaminated soil. The plant is highly tolerant of disturbed sites and can out-compete other vigorous weed species due to its height. As the plant frequently colonises river banks, it can increase the risk of soil erosion as it dies back in winter, leaving bare soil, which its shallow and branched taproot system cannot bind efficiently.

Figure 14 Giant hogweed - Plant

The stem and undersides of the leaves of Giant hogweed are coated with fine hairs that contain a phototoxic sap that renders skin sensitive to ultraviolet (UV) light. The slightest contact with the plant can result in the release of sap, which then gives rise to severe and painful blistering of the skin.

The reaction may take up to 24 hours to occur and may result in permanent recurrent phytophotodermatitis – a type of dermatitis that flares up in sunlight. As the plant hairs are extremely fine and brittle, they can pierce light clothing. In the event of contact with the sap, the skin should be covered to prevent exposure to sunlight and washed immediately with soap and water. Only competent and qualified (and suitably protected) persons shall be given the task of controlling Giant hogweed. Appropriate PPE with skin protection must be worn when undertaking any type of control with this plant.

In Ireland, Giant hogweed is locally widespread, although still absent from much of the midlands. It is frequently encountered in waste ground, along rivers and streams, and in woodland fringes.

6.4.2 Identification

The following provides a brief summary of the defining characteristics of Giant hogweed (for more information see (Caffrey, 1999)):

- It is characterized by its size and can grow to 5m in height, producing large umbels (flower heads) of small white flowers up to 0.8m across (Figure 14)
- It is a perennial plant, forming a rosette of leaves in the first year before sending up a flower spike in the second. The plant typically dies after flowering and setting seed
- It has a ribbed, purple-spotted, hollow stem to 10cm in diameter and covered with hairs and bristles
- It has dark green, deeply lobed leaves up to 2m in diameter and with coarse and serrated edges

It is distinguishable from the native Common hogweed, which does not have hairs or red blotching on its stem, has less dissected leaves and is smaller in all its parts.

6.4.3 Control

The control or management of any IAPS should be undertaken in the four distinct phases outlined in GE-ENV-01104. It is recommended that a suitably qualified ecologist or horticulturalist with sufficient training, experience and knowledge in the control of IAPS should be employed to assist in the planning and execution of control measures in relation to Giant hogweed. In addition, those involved in the control of Giant hogweed may be advised to have access to the advice of a Registered Pesticide Advisor on the register established by the Minister for Agriculture, Food and the Marine pursuant to Regulation 4 of the Sustainable Use of Pesticides Regulations. All pesticide users must be registered and have the appropriate training necessary to carry out the proposed method of control.

The control of Giant hogweed should aim to eradicate the plant entirely or at minimum, prevent the plant from producing seed. As some seeds may remain viable for up to 15 years, control will require continued input over several years to be complete. Soil within 4m of established plants is likely to contain large numbers of seed from previous years' flowering and should not be transferred to other parts of a site unless as part of a targeted control measure (refer to GE-ENV-01104 Biosecurity Measures). The majority of seeds, however, are contained within the top 5cm of soil and most will only persist for 1–2 years (Booy, et al., 2015). Such soil and all vegetative material should not be stock-piled within 10m of any watercourse due to the risk of material being transferred by water.

Due to its phototoxic sap, a risk assessment must be prepared in advance of attempts at any control treatments. All operatives engaged in Giant hogweed control and personnel working on the site must be made fully aware of the phototoxic nature of the plants sap and its potential to result in permanent recurrent phytophotodermatitis. Personnel engaged in controlling Giant hogweed must wear complete PPE which includes gloves, goggles, head protection. Haulage contractors involved in transporting infected material to landfill and the landfill operators must similarly be made aware of the risks.

Infected material being transferred from the site must be covered to avoid accidental spillage and spread during transport.

Monitoring of the site and subsequent follow-up control treatment of Giant hogweed seedlings will be required for a minimum of five years following treatment or after any soil disturbance at the site.

6.4.3.1 Chemical control

The use of herbicides for Giant hogweed control is effective but will require follow-up treatment to deal with seedling growth, even where the initial infestation of parental plants has been controlled. Where a site contains sensitive native vegetation, Giant hogweed is best controlled by injecting herbicide into the stem. Foliar spray application should be undertaken before the flowering stem has fully elongated in March or early April. A further herbicide treatment in September will kill any regrowth or late developing plants or seedlings. Any plants that have flowered, or are likely to flower, should be dead headed or chopped down before seeds are produced.

6.4.3.2 Physical control

All personnel engaged in control must be made aware of the serious health, safety and environmental risks associated with the plant and provided with complete PPE.

Young plants can be readily pulled or teased out of the soil using hand tools. This is best undertaken when the soil is moist following recent rain and care should be taken to extract the plants intact.

Where plants are larger than approximately 1.5m, the upper part can be cut back and the lower part of the stem used to lever the roots out. The central crown of the taproot must be removed to prevent the plant regenerating; small fibrous side roots that may remain in the ground cannot regenerate. Where plants are well-established, continuous germination of seedlings will occur following the removal of mature plants and periodic removal of these will be required to ensure ongoing control.

Seed heads on old stems should be removed and bagged. The flowering stem should then be cut to prevent any further regrowth.

Seedlings are best left for a few weeks to establish as they are easier to remove at this stage.

Follow-up removal and/or monitoring will be required for a minimum of five years to ensure complete control. Subsequent soil disturbance in the area however, may give rise to a new flush of seedlings. Mowers and strimmers must not be used as they tend only to stimulate additional budding on the root crown, do not reduce the plants rigour, and can flail sap onto operators.

6.5 Indian or Himalayan balsam (*Impatiens glandulifera*)

6.5.1 Ecology and Distribution

Himalayan balsam is a member of the Busy lizzie family (Balsaminaceae) and, as its name suggests, is native to the Himalaya region of Asia. It was first introduced to Ireland as a garden plant in the mid-1800s and became popular, often promoted by bee keepers because of the high nectar content of the flowers (Millane & Caffrey, 2014). Himalayan balsam quite swiftly became established along waterways and in other damp places as a result of its prolific seed production. It is an annual plant, forming dense stands up to 3m tall, which effectively shade out and competitively exclude native herbs and grasses. The leaves are up to 20cm long, stalked, broadly lanceolate with distinctly serrated margins and a pointed tip. They are arranged in opposite pairs or in loose whorls of 3–5 (Figure 15). They are pale green with a red midrib. It is tolerant of shade and grows abundantly in or adjacent to riparian woodland. In the autumn, it dies back leaving the ground bare and vulnerable to erosion by winter floods. Himalayan balsam is widespread throughout the country but it is particularly prevalent in the north and south-east.

6.5.2 Identification

The following provides a brief summary of the defining characteristics of Himalayan balsam:

- It is an erect and glabrous (hairless) plant that can grow up to 3m in height
- The stems are tall, erect, hollow, succulent, reddish and hexagonal in cross section
- The plant produces an abundance of attractive white to pink/purple flowers in racemes. They are trumpet-shaped and mildly scented
- The seed capsules are up to 25mm long, green to red and hang from a short red stalk. When ripe, the capsules open explosively, propelling the small black seeds up to 7m from the parent plant, which gives it a considerable edge in colonizing new ground. The seeds can remain viable for up to 18 months and are readily dispersed in water
- Germination commences in February and first young plants are normally apparent in early April. Flowering commences in June and can extend into October

Figure 15 Himalayan balsam - Flowers and Foliage

6.5.3 Control

The control or management of any IAPS should be undertaken in the four distinct phases outlined in GE-ENV-01104. It is recommended that a suitably qualified ecologist or horticulturalist with sufficient training, experience and knowledge in the control of IAPS should be employed to assist in the planning and execution of control measures in relation to Himalayan balsam. In addition, those involved in the control of Himalayan balsam may be advised to have access to the advice of a Registered Pesticide Advisor on the register established by the Minister for Agriculture, Food and the Marine pursuant to Regulation 4 of the Sustainable Use of Pesticides Regulations. All pesticide users must be registered and have the appropriate training necessary to carry out the proposed method of control.

Control measures for Himalayan balsam should aim to prevent flowering and should, therefore, be undertaken before June. Where flower production can be prevented, eradication may be possible over two years with rigorous treatment, however, close monitoring is required to ensure that regrowth does not occur due to viable seeds remaining in the soil.

6.5.3.1 Chemical control

Chemical control of Himalayan balsam is possible and the use of glyphosate-based products can provide a very successful outcome. As the plant is an annual and the roots are extremely short, it is not necessary to hold off spraying until after flowering, as with deep rooted, rhizomatous and perennial species. Treatment in late May or early June will provide a good kill of treated plants but seeds from the previous season will germinate to replace the treated individuals and further spraying will be required in August or September. Since the seeds can remain dormant for more than one year, spraying, as in the first year will be required in the subsequent season. In Years 3 and 4, if no seeds have been deposited in the area, few plants should survive but monitoring and localised retreatment will be required.

6.5.3.2 Physical control

Mechanical control of Himalayan balsam is only likely to be effective where good access is available and the ground is smooth or level enough to permit either mowing or cutting. Where accessible, plants can be cut, mown or strimmed back to ground level before flowering in June. Do not cut earlier as this promotes greater seed production in plants that regrow. Unless the plant is cut to below the lowest node, it will re-sprout. Regular mowing will control the plant, provided the frequency of mowing is regular enough to prevent sprouting and flower formation. This should be repeated annually until complete control is achieved.

As the plants are very shallow-rooted, they can also be easily pulled from the ground by hand. Himalayan balsam has no spines, thorns or stinging cells and, hence, is not a danger to those doing the pulling, although it is always recommended to wear gloves as brambles and nettles commonly grow amongst the stands of Himalayan balsam plants. This control method, commonly referred to as ‘balsam bashing’, should be conducted in late April or early May when the plants are *circa* 1m high. This puts less strain on the back of those pulling the plants. The pulled plants should be broken to discourage flowering, which can occur even with plants that have been removed from the ground. The broken plants can be placed in piles to rot naturally. Because seeds from the previous season will germinate and produce new plants following hand pulling in April or May, the exercise will need to be repeated later in the season, probably in August. As with herbicide spraying, hand pulling will be required the following year to account for the fact that seeds are capable of surviving for at least one year. Monitoring and localised hand pulling should be conducted for the following two years or as monitoring dictates.

Vegetative material can be disposed of by composting provided the compost will not be disturbed for a minimum of two years. Material may also be disposed of to a licensed landfill or incineration facility, or the material could be disposed of by shallow or deep burial.

6.6 Giant rhubarb (*Gunnera tinctoria*)

6.6.1 Ecology and Distribution

Giant rhubarb, a member of the Gunneraceae family (not related to the familiar garden rhubarb), is a native of Chile that was probably first introduced to Ireland as an ornamental garden plant. It has naturalized particularly well along the milder and wetter western seaboard where conditions are comparable to its former range, growing on coastal cliffs, wet and damp meadows, boggy ground, roadsides and along waterways (Figure 16). Large colonies of Giant rhubarb can rapidly dominate and outcompete native species by shading out natural light.

When the plant dies back in winter, large areas of soil are left exposed and, therefore, more susceptible to erosion, particularly on coastal cliffs and along waterways. The decaying material in winter is unsightly and often acts as a trap for litter. The large volumes of decaying leaf material can block drainage channels, increasing the risk of flooding.

It is able to thrive in low nutrient and immature soils such as on sedimentary cliffs, exposed moraines, and disturbed soil sites. It is significantly tolerant to salt spray and is found growing right to the shore on Achill Island and in parts of Connemara, and appears to thrive in water-logged situations, growing in stream beds and wet meadows. It does not appear to do well in well-drained or drought-prone soils. Its massive leaves enable it to out-shade other herbaceous plants and grasses and it spreads rapidly by rhizomes and seeds to form extensive monotypic stands and can block drainage ditches, streams and obstruct access

Brazilian rhubarb (*Gunnera manicata*), although related to Giant rhubarb, is not as widely established in Ireland. The most reliable method of distinguishing between the two species is *via* their inflorescence, with Brazilian rhubarb producing inflorescences that are generally longer than 1m and produce large numbers of slender soft fruits that are each longer than 10cm.

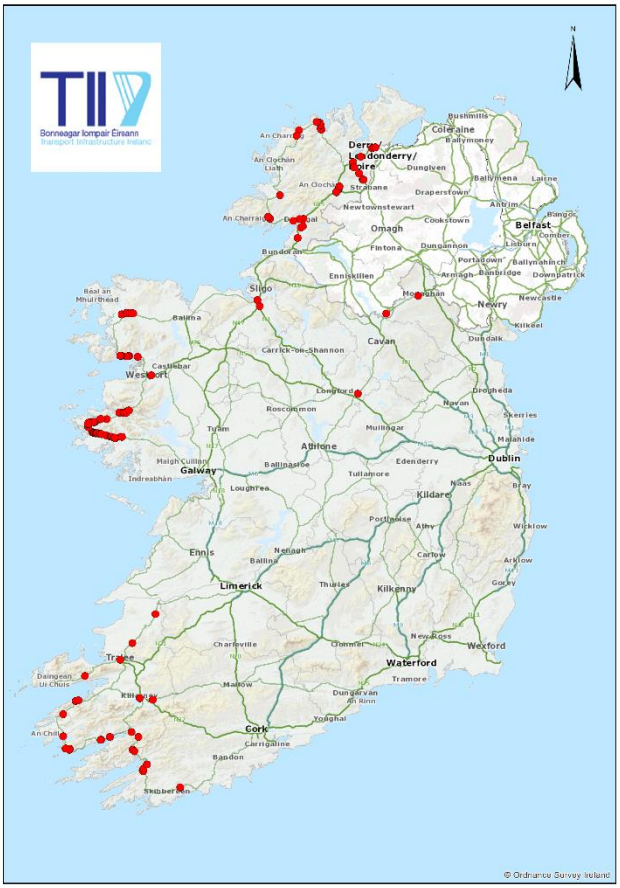

Figure 16 Distribution of Giant rhubarb along the national road network in Ireland

6.6.2 Identification

The following provides a brief summary of the defining characteristics of Giant rhubarb:

- It has characteristically large, rhubarb-like, dark green, lobed leaves (up to 200cm in diameter) borne on erect, stout leaf stalks up to 150cm tall.

The leaves and stalks are covered with pale bristles and weak spines (spines are more numerous and robust on Brazilian rhubarb)

- The perennial, brown, creeping rhizomatous rootstock commonly grows above ground
- The inflorescence is an erect cone-like structure up to 100cm tall with large numbers of stout fruits, each less than 8cm long
- It produces up to 250,000 small, red or orange viable seeds per mature plant
- The leaves die back in winter and expose large dormant buds that are covered in pinkish scales

Figure 17 Gunnera tinctoria - Foliage

6.6.3 Control

The control or management of any IAPS should be undertaken in the four distinct phases outlined in GE-ENV-01104. It is recommended that a suitably qualified ecologist or horticulturalist with sufficient training, experience and knowledge in the control of IAPS should be employed to assist in the planning and execution of control measures in relation to Giant knotweed. In addition, those involved in the control of Giant knotweed may be advised to have access to the advice of a Registered Pesticide Advisor on the register established by the Minister for Agriculture, Food and the Marine pursuant to Regulation 4 of the Sustainable Use of Pesticides Regulations. All pesticide users must be registered and have the appropriate training necessary to carry out the proposed method of control.

Due to its ability to regenerate and spread *via* rhizomes, great care must be taken when managing Giant rhubarb (refer to GE-ENV-01104 Biosecurity Measures). Eradication of this species may take a number of years in order to ensure that no viable rhizomes or seeds material remains in the soil.

6.6.3.1 Chemical control

Herbicide treatment of Giant rhubarb is often the most efficient method of control, particularly when treating large areas of infestation. Experimental control of Giant rhubarb on Achill Island is being carried out using glyphosate and other herbicides to treat infestations.

Results from these trials suggest that the application of herbicide at the end of the growing season (August–September) is most effective, but follow-up treatment is required to deal with re-growth from viable rhizomes and subsequent seedling germination.

6.6.3.2 Physical control

Due to the size of mature Giant rhubarb plants, physical control is most practical and successful with small or recently established infestations. As the plant is capable of regeneration from rhizome fragments, all material must be handled and disposed of in a way which does not result risk further spread. Removal of flower spikes before they set seed is important and will limit seed dispersal of the plant. Follow-up control over a number of years will be required, as monitoring dictates, to deal with regrowth and subsequent seedling germination.

6.7 Montbretia (*Crocosmia x crocosmiiflora*)

6.7.1 Ecology and Distribution

Montbretia is a member of the Iris family (Iridaceae), native to the grasslands of the Cape Region in South Africa. It is an artificially produced horticultural hybrid that has become invasive in many parts of Europe and New Zealand. It is widespread in many parts of Ireland, particularly in the west and south-west. Montbretia thrives in mild, damp conditions and can be found in wet grasslands, hedgerows and along roadsides. It out-competes local flora by forming large, dense stands and displaces native vegetation by shading ground cover plants (Figure 18).

6.7.2 Identification

The following provides a brief summary of the defining characteristics of Montbretia:

- It is a perennial herb that produces strings of flattened underground corms. (A corm is a bulb-like organ or underground stem that acts as a vegetative reproductive structure and food store for the plant.) The corms form linear chains, with the oldest buried deepest in the soil. The chains are fragile and corms readily break off to produce their own root network, giving the plant a ready means of vegetative spread
- The linear leaves are up to 50cm in length and may not die back completely in winter. They are strap-shaped with a conspicuously raised midrib and pointed tip.
- The bright reddish-orange, trumpet-shaped flowers are produced in a loose terminal panicle on slender stems up to 90cm tall (flowering takes place between July and September). The flowers are capable of producing viable seed, which further aids the local spread and further dispersal of the plant

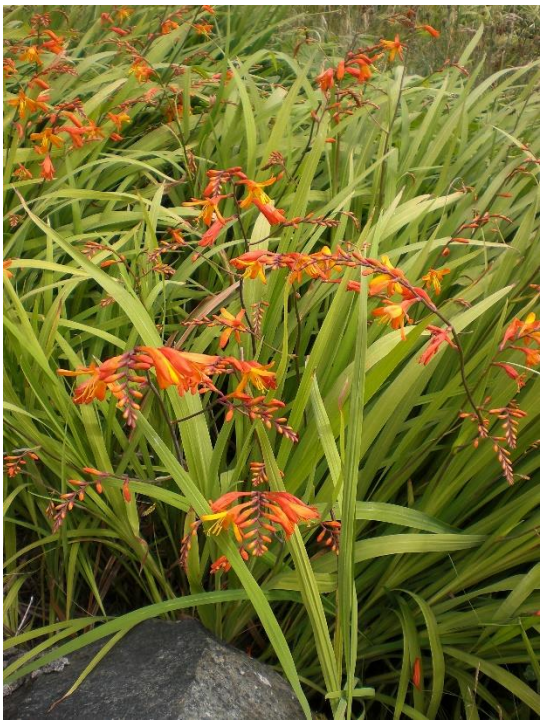

Figure 18 Montbretia - Flowers and Foliage

6.7.3 Control

The control or management of any IAPS should be undertaken in the four distinct phases outlined in GE-ENV-01104. It is recommended that a suitably qualified ecologist or horticulturalist with sufficient training, experience and knowledge in the control of IAPS should be employed to assist in the planning and execution of control measures in relation to Montbretia. In addition, those involved in the control of Montbretia may be advised to have access to the advice of a Registered Pesticide Advisor on the register established by the Minister for Agriculture, Food and the Marine pursuant to Regulation 4 of the Sustainable Use of Pesticides Regulations. All pesticide users must be registered and have the appropriate training necessary to carry out the proposed method of control.

Because of its ability to regenerate and spread *via* underground corms or rhizome material, great care must be taken when managing Montbretia (refer to GE-ENV-01104 Biosecurity Measures). Eradication of this species may take a number of years in order to ensure no viable material remains in the soil.

6.7.3.1 Chemical control

Infestations of Montbretia can be effectively treated with herbicide during the active growing season. Due to the potential for re-infestation from seeds, corms and/or rhizome fragments, regular monitoring and follow-up treatment, as dictated by the monitoring, will be required over a number of years.

6.7.3.2 Physical control

Physical control of Montbretia is difficult as individual corms easily break from their chains and can result in ready re-infestation or further spread. Where infestations are limited in extent, the entire stand can be excavated and buried or disposed of to a licensed landfill or incineration facility under licence. The most effective time to remove Montbretia is before the flowering/seeding season. The corms are very hardy and are not suitable for composting. Due to the potential for re-infestation from corms, regular follow-up will be required over a number of years to deal with any re-growth.

6.8 Winter heliotrope (*Petasites fragrans*)

6.8.1 Ecology and Distribution

Winter heliotrope, a member of the Asteraceae family, is a low-growing herbaceous plant native to the Mediterranean region. It is established widely in Ireland, particularly in the south of the country. A shade-tolerant species, it is frequently found along roadsides, railway banks, river banks, hedgerows, woodland edges and waste ground. As only the male plant has been recorded in Ireland, its spread is confined to vegetative means. Winter heliotrope (often confused with Butterbur (*Petasites hybridus*) and Coltsfoot (*Tussilago farfara*)) forms large dense monocultures, which exclude native vegetation by shading out light.

6.8.2 Identification

The following provides a brief summary of the defining characteristics of Winter heliotrope:

- It produces large round to kidney-shaped leaves up to 20cm in diameter with regular serration along the margins (Figure 19). The leaves have dull downy hairs underneath that rub off easily
- The foliage appears later in spring (although last year's foliage may not die back completely) and forms a dense carpet to *circa* 30cm in height
- Its pale pink flowers, which are amongst the earliest flowers of the year, appear in December and January and have a distinctive sweet smell
- It has a dense rhizomatous (underground stem) root system, which is extensive but relatively shallow – to *circa* 30cm deep

Figure 19 Winter heliotrope - Flowers and Foliage

6.8.3 Control

The control or management of any IAPS should be undertaken in the four distinct phases outlined in GE-ENV-01104. It is recommended that a suitably qualified ecologist or horticulturalist with sufficient training, experience and knowledge in the control of IAPS should be employed to assist in the planning and execution of control measures in relation to Winter heliotrope.

In addition, those involved in the control of Winter heliotrope may be advised to have access to the advice of a Registered Pesticide Advisor on the register established by the Minister for Agriculture, Food and the Marine pursuant to Regulation 4 of the Sustainable Use of Pesticides Regulations. All pesticide users must be registered and have the appropriate training necessary to carry out the proposed method of control.

Due to its ability to regenerate and spread *via* rhizome material, great care must be taken when managing Winter heliotrope. Eradication of this species may take a number of years as it is important to ensure that no viable rhizome material remains in the soil.

6.8.3.1 Chemical control

Infestations of Winter heliotrope can be treated with herbicide during the active growing season. Due to the potential for re-infestation from rhizome fragments, follow-up treatments will be required to deal with any re-growth.

6.8.3.2 Physical control

Due to its extensive rhizome network, which extends to *circa* 30cm deep, total physical removal of Winter heliotrope is difficult to achieve. Where mechanical means can be employed, it should be possible to deal with larger infestations but due to the potential for regeneration from rhizome fragments, it may be best to tackle its control using a combination of excavation with follow-up treatment by herbicides. As with other plants with the potential to spread from small rhizome fragments, disposal of material should be undertaken with due caution to prevent accidental spread of the plant (refer to GE-ENV-01104 Biosecurity Measures). Other means of disposal include burial of material at a depth of at least 0.5m, incineration or disposal to licensed landfill. Insert caveat

6.9 Old man's beard (*Clematis vitalba*)

6.9.1 Ecology and Distribution

Old man's beard, also known as Traveller's joy, is a member of the Ranunculaceae family. It is a vigorous, fast-growing deciduous climber that produces characteristic feathery seed heads in the late summer, from which it derives its common name. It is a native of central and southern Europe, but has established itself throughout much of Europe, North America and New Zealand, where it has become a major weed of woodlands. In Ireland, its distribution is mainly in the eastern and southern half of the country, where it is found in hedgerows, roadsides, rail corridors, river banks and along forest edges. The vines can form dense thickets (growing up to 10m in a season), blanketing trees and shrubs (Figure 20) and ultimately depriving them of light. They can break tree limbs or cause their collapse from the sheer weight and mass. The blanketing growth of the plant also prevents growth and regeneration of native flora by blocking light and physically excluding plants. Hanging vines will set root at any node that comes into contact with the ground and produce new plants.

Figure 20 Clematis vitalba - Winter Vines

6.9.2 Identification

The following provides a brief summary of the defining characteristics of Old man's beard:

- It has pinnate leaves with three but more normally five leaflets on mature plants
- The vines or stems are pale brown and have strong longitudinal ribs and furrows.
- The flowers are produced in late summer to early autumn and are green-white and mildly fragrant (Figure 21)
- The feathery seed heads (achenes) (Figure 22), which are produced in abundance in autumn, remain on the plant through the winter and are dispersed by wind, water, animals or humans Individual plants can produce up to 100,000 seeds per season
- After three years of growth, plants can produce viable seeds, which may remain viable in the soil for up to five years
- The hanging vines will set root at any node that comes into contact with the ground and produce new plants
- Cut/broken stems or stumps have the capacity to re-sprout

Figure 21 Clematis vitalba - Flowers and Foliage

Figure 22 Clematis vitalba - Seeds

6.9.3 Control

The control or management of any IAPS should be undertaken in the four distinct phases outlined in GE-ENV-01104. It is recommended that a suitably qualified ecologist or horticulturalist with sufficient training, experience and knowledge in the control of IAPS should be employed to assist in the planning and execution of control measures in relation to Old man's beard. In addition, those involved in the control of Old man's beard may be advised to have access to the advice of a Registered Pesticide Advisor on the register established by the Minister for Agriculture, Food and the Marine pursuant to Regulation 4 of the Sustainable Use of Pesticides Regulations. All pesticide users must be registered and have the appropriate training necessary to carry out the proposed method of control.

Old man's beard can be controlled both mechanically and using herbicides, although typically its control relies on a combination of both, i.e. cut-stump application.

6.9.3.1 Chemical control

A number of chemicals have been used effectively against Old man's beard, including glyphosate and triclopyr, although control invariably takes more than one year. Foliar application of herbicides should be undertaken while the plant is actively growing. Due to the sheer biomass of vegetation that the plant can produce, it may be difficult to access infested sites to implement control measures. For large, extensive infestations of Old man's beard, chemical treatment should be carried out in June or July when the plant is growing vigorously and in full leaf, using specialised spraying equipment to target the tall canopy layer. The purpose of this is to minimise the amount of herbicide that will reach the host tree or shrubs underneath.

6.9.3.2 Physical control

At newly infested sites, small seedlings can be manually pulled, preferably during damp conditions (i.e. during winter or spring). The seedlings should be collected for composting, adopting the biosecurity measures outlined in GE-ENV-01104. Where isolated mature aerial vegetation is present, the vines should be manually pulled and bagged. The thin stems that remain rooted in the soil may now be manually pulled and removed for composting in a biosecure manner, along with the aerial vegetation. Where Old man's beard has only recently invaded an area and not yet produced dense foliage, the aerial vegetation may be cut and left to die. The roots and seedlings left in the ground may then be removed manually or treated with herbicide (refer to Section 6.9.3.1).

6.9.3.3 Combined chemical and physical control

For combined treatment of dense infestations of mature aerial Old man's beard vegetation, the vines should be cut back to around 10cm above ground level and the cut stems that remain in the ground immediately painted with a concentrated dose of approved herbicide. They may also be dug from the ground and removed for composting, if this is practicable. The aerial vines can be left hanging to die naturally. This method will minimise the impact on the host plant that the plant is covering. For large old specimens, the stem or trunk can be cut at the base with a straight horizontal cut and herbicide applied immediately to the cut stump. The aerial vegetation should be left *in situ* until it is dead. Cut and treated stumps can resprout and must be monitored and retreated, as necessary.

6.10 Rhododendron (*Rhododendron ponticum*)

6.10.1 Ecology and Distribution

Rhododendron is a perennial evergreen, acid-loving shrub that was introduced to Ireland in the 18th Century. It is native to south-west Europe and south-west Asia. There are more than 900 species of Rhododendron, but only one, *Rhododendron ponticum,* is invasive in Ireland. Since then, it has established itself as a major weed of acid woodlands, most notably in Kerry and Donegal where concerted efforts to control it have been ongoing for many decades. It is only likely to be a problematic species on road schemes in areas of acid or peaty soils.

Rhododendron produces masses of showy lilac flowers in May, which help endear it to members of the public. Each flower head can produce between 3,000 and 7,000 tiny seeds. The small, light seeds are produced in capsules and have a high germination rate. They are primarily dispersed by wind and can persist in soils for up to three years. The plant can also spread by vegetative means where plants sucker or throw up new sprouts from roots as well as from branches (layering). It forms dense thickets that can exclude all light from the understorey thereby eliminating herbaceous plants and preventing the natural regeneration of trees and shrubs It can withstand considerable shade and thrives as an understorey species in woodland, although it also tolerates open conditions in suitable acid soils.

Its dense tangle of stems, commonly referred to as thickets, can block pathways, smother watercourses and encroach on roadways, thereby impinging on sight-lines and reducing the capacity of the road to dry out. The dense foliage of Rhododendron can reach several metres in height, creating a dark sterile environment that outcompetes native flora. The leaf litter produced by the plant contains various compounds that have an allelopathic action on other species (inhibiting their growth), which may further inhibit native flora from growing within close proximity. These toxins, which include'free' phenols make the plant unpalatable to most herbivores and grazing animals.

Rhododendron ponticum is also a carrier of the fungus-like pathogen *Phytophthora ramorum* that causes 'Sudden Oak Death', which can cause significant damage to a wide range of native flora.

6.10.2 Identification

The following provides a brief summary of the defining characteristics of *Rhododendron ponticum*:

- It is a woody shrub or small tree growing up to 8m in height
- As a member of the Ericaceae (heather family) and grows optimally on soils with a low pH
- It has oval, waxy leaves up to 18cm in length, which are darker above than below (Figure 23) The leaves are produced in a spiral at the end of each stem
- The roots are relatively shallow, seldom being deeper than 45cm, and typically extend uphill from the plant
- The bell-shaped flowers are produced in a cluster at the tips of branches (Figure 24) and can vary in colour from pink to various shades of purple

Figure 23 Rhododendron ponticum - Foliage

Figure 24 Rhododendron ponticum - Flowers and Foliage

6.10.3 Control

The control or management of any IAPS should be undertaken in the four distinct phases outlined in GE-ENV-01104. It is recommended that a suitably qualified ecologist or horticulturalist with sufficient training, experience and knowledge in the control of IAPS should be employed to assist in the planning and execution of control measures in relation to Rhododendron. In addition, those involved in the control of Rhododendron may be advised to have access to the advice of a Registered Pesticide Advisor on the register established by the Minister for Agriculture, Food and the Marine pursuant to Regulation 4 of the Sustainable Use of Pesticides Regulations. All pesticide users must be registered and have the appropriate training necessary to carry out the proposed method of control.

Considerable effort has been focused on the control of Rhododendron, particularly in woodland habitats, in Ireland and elsewhere in the northern hemisphere. The choice of control method can influence the recovery of the site and should be considered prior to undertaking any control operation. Rhododendron grows vigorously when cut and the tiny seeds may be unintentionally spread by machinery, on clothes, boots, or other PPE. Hence, biosecurity measures must be put in place to prevent further spread of the plant when undertaking any control works. Regular follow-up is required to deal with re-growth and seedling germination, irrespective of the control method employed.

6.10.3.1 Chemical control

When dealing with large Rhododendron infestations, foliar spraying with herbicides is not recommended. This reflects the fact that considerable quantities of herbicide will be required, which can have effects on understorey flora beneath the target species and cause significant drift that will impact other non-target species. However, if access to the base of the main stems is possible, herbicide may be applied directly to the stem. Stem injection is another option for chemical control that involves herbicide application directly into the stems of large plants. This method enables a more precise application of the herbicide. Holes > 3cm diameter should be drilled into the stem and herbicide applied immediately. Herbicides should be applied during periods of active growth, i.e. late spring or summer.

6.10.3.2 Physical control

A range of physical control measures have been developed for Rhododendron in response to the general sensitivity of acid woodland (and other) sites where it is frequently established (collateral damage by chemical spray drift on non-target species is a prime concern in such sites). Manual pulling of plants that are less than 20cm high is successful, once all of the roots are removed. The pulled material should be bagged for removal from site. It is also an option to flail and or mulch young material, and to leave the mulch on site. As there will be no seeds present (the plant does not seed until it is 10–12 years old), it is possible to leave this material on site.

Cutting of large stems is another physical control option; however, the plant's capacity for regeneration from suckers that emerge from roots or stems that remain in the ground renders this method relatively ineffective unless applied in areas of limited infestation, where adequate follow-up can be made. This approach can also be very labour-intensive and expensive.

It is possible to mechanically uproot mature Rhododendron plants due to the shallow nature of the root system. However, this is generally only appropriate for sites where access to machinery is possible and at sites of low ecological interest where damage to existing native vegetation is not a concern. Where chemical control of cut stumps and rootstocks is not an option, stump extraction will be necessary. This will normally involve using machinery, where access is possible.

Heavy trafficking of woodland soils can result in puddling of soils, giving rise to sediment run-off and nutrient leaching which can impact on watercourses.

6.10.3.3 Combined chemical and physical control

With isolated plants (> 1m tall) or small infestations, effective control can be achieved by cutting the plant to the stump and immediately treating the latter with herbicide. The use of an inert dye mixed with the herbicide will ensure that no stumps are missed. Another option is to cut the stem and treat the tender regrowth with herbicide. For plants with a stem diameter less than 2cm, the stem can be broken at the base ensuring that it is not fully severed and a concentrated solution of herbicide immediately applied. For plants greater than 2cm in diameter, notches can be cut in the stem using a hatched or saw (referred to as feathering) and a concentrated solution of herbicide immediately applied. It is important to apply shallow cuts so that the herbicide has access to the plant's transport system, which is just inside the bark.

This type of treatment is effective all year-round, although it is deemed to be most effective when conducted between November and April.

Regular follow-up is required to deal with re-growth and seedling germination, irrespective of the control method employed.

Any cut material will need to be removed from the site to avoid resprouting or suckering, which will produce new plants and potential infestations. Mulching is a good option for disposal and the mulch may be left on site, if no seeds are present.

6.11 Buddleia (*Buddleja davidii*)

6.11.1 Ecology and Distribution

Buddleia (also known as the Butterfly bush) is a member of the Buddlejaceae family. It is a very fast-growing shrub that can reach 2m in its first year, producing flowers and setting seed prolifically.

Buddleia is a native of China and is widely planted as an ornamental in gardens, demesnes or parks. Because of its profusion of long, purple and nectar-rich flowers it also attracts a considerable diversity of butterflies (hence, its other common name – Butterfly bush) and other pollinating insects.

It has a widespread distribution throughout Ireland and is particularly frequent in waste ground in urban environments. It colonises bare ground very rapidly and can quickly form monotypic stands.

As Buddleia tolerates a broad range of environmental conditions and a wide diversity of soil types, including very poor soils, it is capable of growing on walls, rock outcrops or sub-soils; conditions that are frequently encountered on new road schemes. In particular, it poses a threat where features such as rock cuttings or eskers remain abandoned or are left to re-colonize naturally. In many countries it has established itself as a problem plant along watercourses where, due to its shallow root system, it is frequently washed away, resulting in erosion of the river banks and downstream blockages. In Ireland, Buddleia must be considered an invasive species because of the damage it can cause to hard standings and structures, and to native biodiversity.

Buddleia produces very large numbers of viable seeds, which are dispersed *via* wind and water. The seeds are relatively short-lived in the soil, rarely lasting longer than four years. The plant can also readily spread by producing roots, and ultimately new plants, where stem nodes come into contact with the ground. It can also spread by fragmentation of stems or roots.

6.11.2 Identification

The following provides a brief summary of the defining characteristics of Buddleia:

- It is a multi-stemmed, perennial, woodyshrub reaching up to 4m in height, with arching branches
- The leaves are up to 20cm in length, lanceolate with a slightly serrated edge, deep green above and felted whitish underneath
- Flowers are present in dense pyramidal panicles that are normally lilac or purple in colour but may be pink, red or even white (Figure 25). Flowering occurs between June and September
- The plant is deciduous, although in winter the desiccated flower heads and seed capsules remain on the bush
- The seeds produced are very small and numerous, with up to 3 million tiny winged seeds produced per plant. They can remain viable in the soil for up to four years.

Figure 25 Buddleia - Flowers and Foliage

6.11.3 Control

The control or management of any IAPS should be undertaken in the four distinct phases outlined in GE-ENV-01104. It is recommended that a suitably qualified ecologist or horticulturalist with sufficient training, experience and knowledge in the control of IAPS should be employed to assist in the planning and execution of control measures in relation to Buddleia. In addition, those involved in the control of Buddleia may be advised to have access to the advice of a Registered Pesticide Advisor on the register established by the Minister for Agriculture, Food and the Marine pursuant to Regulation 4 of the Sustainable Use of Pesticides Regulations. All pesticide users must be registered and have the appropriate training necessary to carry out the proposed method of control.

As Buddleia is a plant that favours disturbed sites, physical removal of plants can provide ideal conditions for the germination of seeds that are present in the soil. For this reason, care needs to be taken to ensure that revegetation of treated areas is undertaken swiftly. The branches of Buddleia are capable of rooting as cuttings, so care should also be taken to ensure material is disposed of in a manner to avoid this risk.

6.11.3.1 Chemical control

Foliar application of herbicide is capable of providing control with young plants and small infestations, but should be followed up at six-monthly intervals as regrowth is common.

6.11.3.2 Physical control

Removal of the flower heads before seed set (June or even July) is an important control method as it reduces the volume of seeds that are available to spread. Hand-picking of young plants will provide control but it is very tedious and should be undertaken with care to avoid soil disturbance, which can give rise to a flush of new seedling.

Digging out plants is only practical with relatively minor infestations, at the initial stage of invasion, or where a site is to be excavated for development or road construction purposes. Mowing of young plants does not provide effective control as they re-sprout with vigour. The physical removal of mature stands is not recommended for the same reason. After uprooting, it is essential to plant the ground in order to prevent a flush of new seedling growth.

When Buddleia plants are cut, regrowth from the stump can be very vigorous.

6.11.3.3 Combined chemical and physical control

Effective control can be achieved by cutting Buddleia plants to a basal stump during active growth (late spring to early summer) and immediately treating the total cut surface with herbicide concentrate. Monitoring will be required and retreatment, as necessary.

Do not leave cut stems and branches on the ground as they will reroot and produce new plants.

6.12 Invasive Alien Plant Species of Potential Concern

This section provides information on IAPS that are of potential future concern in Ireland. Several of these are listed on the Third Schedule to the European Communities (Birds and Natural Habitats) Regulations, 2011 as species that are subject to restrictions under this legislation. The information provided in this sections is intended to highlight the potential risks these species pose to native biodiversity in Ireland.

6.12.1 Himalayan honeysuckle (*Leycesteria formosa*)

Himalayan honeysuckle (also known as Pheasant berry or Flowering nutmeg) is a deciduous, perennial woodyshrub and member of the Caprifoliaceae family, native to the Himalayas and south-western China. It is likely an escapee from cultivation in Ireland and is mostly found in woodlands, roadsides, railway banks and quarries (Reynolds, 2002). Himalayan honeysuckle is still widely sold as an ornamental plant and is often used as a hedging plant to provide cover for pheasants (Preston, et al., 2002). It is well established in the south-east of the country.

Himalayan honeysuckle flowers from June to the end of October, producing long, hanging clusters of bell-shaped flowers (Figure 26). Its large, red-purple berry-like fruits are widely dispersed by birds (Heleno, et al., 2011). Its bamboo-like stems can grow up to 2m tall and commonly form dense thickets, which can dominate hedgerows and displace native species (Booy, et al., 2015).

Figure 26 Himalayan honeysuckle - Flowers and Foliage [Photograph: Pádraig Whelan]

6.12.2 Russian vine (*Fallopia baldschuanica)*

Russian vine is a member of the Polygonaceae (docks and rhubarb family) and is native to central Asia. It is often named Silver lace vine or Mile-a-minute vine, but it can be mistaken for Mile-a-minute weed (*Persicaria perfoliata*), also a member of the Polygonaceae family. Russian vine is a popular garden plant that is still being sold in Ireland under the synonyms *Fallopia aubertii* and *Polygonum aubertii* (National Biodiversity Data Centre, n.d.). It is often purposely grown as a hedging plant but has escaped into the wild and successfully established via garden discards or broken stem fragments (Reynolds, 2002). It is commonly present on railway embankments or waste grounds in Ireland, as it tolerates a wide range of soil conditions.

Russian vine is a deciduous, woody climbing perennial that spreads vigorously, forming a mass of greenish red stems to10m long (Booy, et al., 2015). Its leaves are simple and ovate; they emerge tinged with red but mature to a bright green colour (Figure 27). It produces masses of small, creamy white flowers in profuse narrow panicles on the shoot tips between May and October. Russian vine does not set seed in Ireland but spreads vegetatively by rhizomes (underground stems). It is a species of concern in Ireland as it has been known to hybridise with Japanese knotweed to produce the Railway-yard knotweed (*Fallopia x conollyana*) (Bailey, 2001), though that species is thought to be rare in Britain and has not been recorded in Ireland (Bailey, 2001; Booy, et al., 2015).

Figure 27 Russian vine - Flowers and Foliage [Photograph: Pádraig Whelan]

6.12.3 Spanish bluebell (Hyacinthoides hispanica)

Spanish bluebell is a bulbous perennial, native to Spain, Portugal and northwest Africa that was introduced to Ireland by the horticultural industry. It is an escapee from cultivation, established mainly in woodland, on roadsides and waste ground in Ireland (Reynolds, 2002). The common bluebell (*Hyacinthoides non-scripta*) is native to Ireland but hybridizes readily with Spanish bluebell to form the hybrid *H. non-scripta x hispanica,* also known as *H. x massartiana*. In the wild, this hybrid arises spontaneously where the native and/or introduced ranges of the parents meet (Taylor, 2002). The hybrid is fertile, producing abundant seed and possesses physical features characteristic of both parent plants (Stace, 1997).

The range and frequency of the hybrid is increasing in Ireland but it is still unevenly distributed. The distribution of the Spanish bluebell may also be continuing to expand in Ireland, but as it has long been confused with *H. non-scripta x hispanica*, its abundance may be somewhat over-recorded (Reynolds, 2002). It can spread rapidly and out-compete native spring-blooming species and thus may pose a significant risk to native biodiversity and to the native Common bluebell.

6.12.4 Three-cornered leek (*Allium triquetrum*)

Three-cornered leek, also known as Three-cornered garlic, is a member of the Lily family. It is native to the Mediterranean basin and has become widely established in the east and south-east of Ireland. Three-cornered leek is a bulbous perennial herb with a strong garlic scent. It has narrow, green, strongly keeled and hairless leaves. The flowers are bell-shaped and white, and flowering occurs from April to June. It is often found on roadsides, waste grounds, forests, and riparian and shaded areas in Ireland. Although no impacts of this species have been documented to date, it is known to rapidly colonise and dominate waste ground, outcompeting native vegetation (Booy, et al., 2015). The species is widely available in the horticultural trade in Ireland and human activity is likely the greatest disperser of this species (National Biodiversity Data Centre, n.d.).

7. Glossary of Acronyms

A list of acronyms referred to in this Standard is provided in Table 4.

Table 4 Glossary of acronyms

Acronym	Definition
CIEEM	Chartered Institute of Ecology and Environmental Management
CIRIA	Construction Industry Research and Information Association
CPO	Compulsory Purchase Order
DAFM	Department of Agriculture, Food and the Marine
DoT	Department of Transport
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EOP	Environmental Operating Plan
Esri	Environmental Systems Research Institute
GIS	Geographic Information System
HSA	Health and Safety Authority
IAPS	Invasive Alien Plant Species
IAS	Invasive Alien Species
IEMA	Institute of Environmental Management and Assessment
IOSH	Institution of Occupational Safety and Health
MS	Member States
NBDC	National Biodiversity Data Centre
NPWS	National Parks and Wildlife Service
NRO	National Roads Office
PCS	Pesticide Control Service

Acronym	Definition
PPE	Personal Protective Equipment
PPPs	Plant Protection Products
PRCD	Pesticide Registration and Controls Divisions
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SCD	Standard Construction Detail
SLG CSCS	Signing, Lighting and Guarding at Roadworks Construction Skills Certification Course
TII	Transport Infrastructure Ireland

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Appendix A:

Key Personnel Required for the Management of Invasive Alien Plant Species

The key personnel required for the management of Invasive Alien Plant Species (IAPS) include:

- **Health and Safety Manager:** Must be competent to carry out the duties of the Contractor in compliance with Safety Health and Welfare at Work Act 2005 and Safety Health and Welfare at Work (Construction) Regulations 2013. Minimum of three years' relevant post-qualification experience and be a member (graduate member or higher) of a relevant professional body, such as the Institution of Occupational Safety and Health (IOSH).
- **Competent Person:** The assessment, design, installation, maintenance and removal of Temporary Traffic Management shall comply with the *Guidelines for Working on Roads* (Health and Safety Authority, 2009), the *Temporary Traffic Management Design Guidance* (Department of Transport, 2019) and the *Temporary Traffic Management Operations Guidance* (Department of Transport, 2019) A competent person must have training, experience and knowledge commensurate with the size or hazards (or both) of the TTM tasks to be undertaken. Training, experience and knowledge competency requirements for the TTM Designer, the Temporary Traffic Operations Supervisor and the TTM Operative are set out in the *Temporary Traffic Management Design Guidance* and *Temporary Traffic Management Operations Guidance documents respectively.* Where TTM Works must take place on Level 3 roads the competent person must also have an accredited TTM Level 3 qualification.
- **Registered Professional User:** A professional user of pesticides listed on the register established by the Minister for Agriculture, Food and the Marine pursuant to Regulation 4 of the European Communities (Sustainable Use of Pesticides) Regulations, 2012. The user must have the appropriate training (with associated certificates) necessary to perform the methodology to manage IAPS. Such training might include: training equal or equivalent to the following City and Guilds NPTC Pesticide Training Ireland courses: PA1 – Safe Handling and Application of Pesticides; PA6A – Hand Held Applicator (Knapsack Sprayer); PA6AW – Hand Held Near Water; and, PA6INJ Pesticide Injection.
- **Ecologist or Horticulturalist:** An ecologist or horticulturalist capable, *inter alia*, of identifying the relevant IAPS; and protected or rare habitats and species that could be affected through the management of IAPS. They will also provide advice on the options and timing for IAPS control and management programmes, and recommend and supervise best biosecurity practice. An ecologist must have a degree (Higher Education and Training Awards Council (HETAC)/National Framework of Qualifications (NFQ) Level 7 or equivalent or higher) in biological science or environmental science, or equivalent subject; three years' relevant post-qualification experience; and be a member (graduate member or higher) of a relevant professional body, such as the Chartered Institute of Ecology and Environmental Management (CIEEM) or Institute of Environmental Management and Assessment (IEMA). A horticulturalist must have a degree (Higher Education and Training Awards Council (HETAC)/National Framework of Qualifications (NFQ) Level 7 or equivalent or higher) in horticulture, or equivalent subject; and, three years' relevant post-qualification experience.
- **Geographical Information Systems** In order to fulfil the Geographical Information System (GIS) reporting requirements, a competent person capable of providing geographical information on IAPS infestations and associated treatment methods in a defined format, is required.

- **Land Surveyor:** A competent person capable of surveying with Global Positioning System (GPS), or equivalent, IAPS and other features relevant to the management of same, to a high degree of accuracy and providing the information in an appropriate format.

In addition to having the previously mentioned Key Personnel, it is advised that anyone involved in the chemical control of IAPS have access to the advice of a Registered Pesticide Advisor on the register established by the Minister for Agriculture, Food and the Marine pursuant to Regulation 4 of the European Communities (Sustainable Use of Pesticides) Regulations, 2012. As per Article 3(3) of the Sustainable Use of Pesticides Directive (Directive 2009/128/EC), 'advisor' means any person who has acquired adequate knowledge and advises on pest management and the safe use of pesticides, in the context of a professional capacity or commercial service, including private self-employed and public advisory services, commercial agents, food producers and retailers, where applicable.

Appendix B:

Submitting Invasive Alien Species Records to the National Invasive Species Database

The national invasive species database is held by the National Biodiversity Data Centre (NBDC) and is intended to provide centralised up-to-date information on the distribution of Invasive Alien Species (IAS) in Ireland.

Maps of the distribution of IAS in Ireland are publicly available through the NBDC's web GIS system. As a tool for the recording of new and the spread of established IAS in Ireland, it is important that the database accurately reflects the current distribution of IAS in Ireland. For that reason, it is important that all observations of IAS within Ireland be submitted to the database, regardless of how widespread the species may be.

To submit a record of an IAS to the national database, you need to record the name of the species, the date on which you observed it, the location of the species and a grid reference. This should be submitted along with your name and the name of the person who identified the species (if different) directly to the NBDC. Further detail on how to submit records to the national database is available at: http://records.biodiversityireland.ie/

Appendix C:

Invasive Alien Plant Species Site Assessment and Outline Management Plan

The management and control of Invasive Alien Plant Species (IAPS) should be undertaken in four distinct phases, as follows:

- Phase 1: Inspect
- Phase 2: Plan
- Phase 3: Control
- Phase 4: Monitor

The information gathered using this protocol will allow those engaged in IAPS control and management to:

- Record/identify IAPS infestations
- Plan the management and control of IAPS
- Implement control methods and track treatments
- Monitor re-growth of IAPS infestations

Phase 1	– Site assessment – Mapping	– Description of site – Habitat mapping – Presence of IAPS – Sensitive receptors – Proximity to designated sites – Topographical survey
Phase 2	– IAPS Management Plan – Costing	– Site management objectives – Treatment required – Risk of re-infestation – Costings of appropriate control strategies – Acquisition of land/Compulsory Purchase Order (CPO) if necessary
Phase 3	– Implement control methods – Treatment reporting	– IAPS control (chemical, physical or a combination of both) – Biosecurity measures – Documentation of method of treatment
Phase 4	– Re-growth monitoring – Re-growth reporting	– Survey re-growth – Report on re-growth – Make provisions for site protection to prevent future IAPS infestations

Bonneagar Iompair Éireann
Transport Infrastructure Ireland

Ionad Ghnó Gheata na Páirce,
Stráid Gheata na Páirce,
Baile Átha Cliath 8, D08 DK10, Éire

Parkgate Business Centre,
Parkgate Street,
Dublin 8, D08 DK10, Ireland

www.tii.ie

info@tii.ie

+353 (01) 646 3600

+353 (01) 646 3601