Appendix D

Invasive Species Report

Dixon.Brosnan

environmental consultants

project title	**Invasive species survey and Invasive Species Management Plan (ISMP) for the Untreated Agglomerations Study – Cork Project (Aghada/Whitegate)**
client	**Arup (on behalf of Irish Water)**
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1. Introduction

Dixon.Brosnan were commissioned by Arup to survey for high risk invasive species for works associated with the upgrade to Aghada/Whitegate Collection and Treatment System and all associated site works at the villages of Whitegate, Upper Aghada, Lower Aghada and Rostellan in County Cork.

The survey and subsequent report was prepared by Carl Dixon M.Sc. and Ian Mc Dermott M.Sc. Carl Dixon has an M.Sc. in ecological monitoring from UCC and over 15 years of experience in ecological consultancy. He has previously surveyed and/or proscribed management measures in relation to high risk invasive species, such as Japanese Knotweed and Himalayan Balsam, for a wide range of projects including the Fermoy Main Drainage Scheme, Great Island Gas Pipeline as well as smaller scale projects. Ian Mc Dermott has an M.Sc. in ecological monitoring and has considerable experience in ecological assessment and surveying for invasive species.

2. Non-native Invasive Species

Non-native plants are defined as those plants which have been introduced outside of their native range by humans and their activities, either purposefully or accidentally. Invasive non-native species 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 patterns; and, (3) resistance to standard weed control methods.

Where a non-native species displays invasive qualities, 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; and, (3) have an adverse effect on landscape quality.

Regulations 49 and 50 of the European Communities (Birds and Natural Habitats) Regulations 2011 make it an offence to plant, disperse, allow dispersal or cause the spread of certain species e.g. Japanese knotweed, Himalayan knotweed and Himalayan Balsam, keep the plant in possession for purpose of sale, breeding, reproduction, propagation, distribution, introduction or release, keep anything from which the plant can be reproduced or propagated from, without a granted licence and keep any vector material for the purposes of breeding, distribution, introduction or release. The Wildlife (Amendment) Act 2000 states that anyone who plants or otherwise causes to grow in a wild state in any place in the State any species of (exotic) flora, or the flowers, roots, seeds or spores of (exotic) flora shall be guilty of an offence.

There is a statutory obligation under S.I. 477 of 2011 of the European Communities (Birds and Natural Habitats) Regulations 2011 to address invasive species in Ireland. With relation to this particular project high risk invasive species like Japanese knotweed (*Fallopia japonica*) is of particular interest. This species for example is listed under the *3rd Schedule: Part 1 – Plants; Non-native species subject to restrictions under Regulations 49 & 50*. Regulation 49 deals with the '*Prohibition on introduction and dispersal*' while Regulation 50 deals with the '*Prohibition on dealing with and keeping certain species*'. Regulation 50 has yet to be brought into Irish law. Regulation 74 is a transitional provision in relation to Regulation 49 and 50.

The EU Regulation (No.1143/2014) on invasive alien species entered into force on 1st January 2015. This Regulation seeks to address the problem of invasive alien species in a comprehensive manner to protect native biodiversity and ecosystem services, as well as to minimize and mitigate the human health or economic impacts that these species can have.

The NBDC lists a number of both aquatic and terrestrial high impact invasive species which have been recorded within the study site (grid square W86 (**Table 1**)).

Table 1: NBDC list of high impact invasive species.

Common Name	Latin Name
Japanese Knotweed	*Fallopia japonica*
Cherry Laurel	*Prunus laurocerasus*
Brown Rat	*Rattus norvegicus*
Fallow Deer	*Dama dama*
Feral Ferret	*Mustela furo*
Canada Goose	*Branta canadensis*
House Mouse	*Mus musculus*
Ruddy Duck	*Oxyura jamaicensis*
Wireweed	*Sargassum muticum*
Hottentot-fig	*Carpobrotus edulis*
Leathery Sea Squirt	*Styela clava*
Eastern Grey Squirrel	*Sciurus carolinensis*

3. Project Description

The existing collection system within the Whitegate-Aghada agglomeration is in need of upgrade and extension, and there are limited wastewater treatment facilities in place for sewage collected in the existing County Council network. The primary objective of the proposed works is to provide a modern Wastewater Collection and Treatment Infrastructure for the Whitegate / Aghada agglomeration in order to meet the needs of the area to 2040, in a scheme that represents the best value for money while complying with the Urban Waste Water Treatment Regulations, the European Communities Environmental Objectives (Surface Water) Regulations, 2009 and the conditions of the Waste Water Discharge Certification. A drawing of the proposed project is included as **Appendix 2** of this report.

As part of the proposed works a three-stage approach was developed in order to identify the preferred treatment and outfall option(s) which include the following main elements:

Rostellan	• Underground wastewater pump station at Thomas Kent Memorial Park, including am underground stormwater storage tank (approx. volume 53m^3). • 1,417m long, 110mm diameter rising main to convey Rostellan Formula 'A' flows to the Lower Aghada network.
Lower Aghada	• Underground wastewater pump station in Lower Aghada, located west of the pier, including an underground stormwater storage tank (approx. 141m^3). • 656m long, 160mm diameter rising main to convey Lower Aghada and Rostellan Formula 'A' flows to the Upper Aghada Network
Whitegate	• Underground wastewater pump station at the Square in Whitegate village, including an underground stormwater storage tank (approx. 240m^3)

	• 1,765m, 315mm diameter long rising main to convey Rostellan, Lower Aghada, Upper Aghada and Whitegate Formula 'A' flows to the WwTP Site.
WWTP	• New wastewater treatment plant which will provide primary treatment
Outfall	• 880m terrestrial gravity sewer sized to convey Formula 'A' to the outfall launch point. • 295m gravity sea outfall sewer (from high water mark) to convey treated effluent to the proposed discharge point in White Bay.

4. Site Survey

A detailed survey for high risk invasive species was carried out on the 18th of January, 20th February and 1st of November 2018 and 11th of December 2019. Japanese Knotweed (*Fallopia japonica*) which is considered a highly problematic species by Invasive Species Ireland was recorded. In addition, Himalayan knotweed (*Persicaria wallichii*) a species classified as an Amber Threat species by Invasive Species Ireland was recorded within or in proximity to the proposed working areas. Himalayan knotweed along with Japanese knotweed are both invasive species listed under Regulations 49 and 50 of the European Communities (Birds and Natural Habitats) Regulations 2011. Although other introduced species were recorded within the works area, these species are not listed as an invasive alien species under Regulations 49 & 50 of the European Communities (Birds and Natural Habitats) Regulations 2011,

It is noted that the figures included in this report provide an overview of Japanese Knotweed and Himalayan knotweed distribution and that root systems of Japanese Knotweed can extend up to 7m from the parent plant. It is also noted that the survey provides a snapshot of current distribution. As high risk invasive species are highly invasive, there may be changes in distribution patterns if sufficient time elapses between this survey and the commencement of works.

In addition to Japanese Knotweed and Himalayan knotweed, the introduced species Winter Heliotrope (*Petasites fragrans*), Montbretia (*Crocosmia × crocosmiflora*), Three-cornered Garlic (*Allium triquetrum*), Cotoneaster (*Cotoneaster spp.*), Butterfly Bush (*Buddleja davidii*) and Travellers Joy / Old Man's Beard (*Clematis vitalba*) were also recorded within the study area. Winter Heliotrope, Montbretia, Three-cornered Garlic, Cotoneaster, Butterfly Bush and Travellers Joy / Old Man's Beard are on the Invasive Species Ireland *"Amber List: Recorded Species"* (which under the right conditions could represent a significant impact on native species or habitats).

Japanese Knotweed, Winter heliotrope, Buddleia and Montbretia are also included in the NRA Guidelines on the Management of Noxious Weeds and Non-native Species on National Roads (NRA, 2010) as these species have been shown to have an adverse impact on landscape quality, native biodiversity or infrastructure

Whilst Montbretia, Buddleia and in particular Winter Heliotrope do not pose a risk to infrastructure (with regard to this project), they are likely to further invade semi-natural habitats and disturbed ground associated with construction activities causing long-term landscape maintenance issues relative to the proposed development with associated costs. Standard

biosecurity measures as outlined in section 11 will be implemented to ensure these species are not spread outside the works area.

Cherry Laurel (*Prunus laurocerasus*) is listed by the National Biodiversity Data Centre as a high risk invasive species. Cherry laurel was recorded within an area of woodland along the R630. The species was recorded on both sides of the road directly across from each other. Cherry laurel is a dense thicket forming invasive ever-green shrub of gardens, parks and woodlands from South West Asia. The leaves are thick and laurel-like and are poisonous with cyanide. Its rapid growth and the way it casts an all–year–round dense shade means that it shades out plants from the woodland floor, and generally out–competes less vigorous shrubs and young trees. Like *Rhododendron ponticum* with which it often grows, if unmanaged, it will form almost impenetrable shrubberies or understories in woodland and effectively kill off all other vegetation except the mature trees. Cherry Laurel will not be impacted by the proposed development.

5. Survey Results

An overview of the locations of the Japanese Knotweed (*Fallopia japonica*) and Himalayan knotweed (*Persicaria wallichii*) are shown in **Figure 1** below, along with GPS coordinates. Photographs are provided in **Appendix 1**. In summary, Japanese Knotweed was recorded at five distinct locations and Himalayan Knotweed was recorded at two. Some sections of these stands are just outside the boundaries of the study area, but have been included due to their proximity. Himalayan knotweed was recorded at two locations. For the purposes of this report Japanese Knotweed and Himalayan knotweed are considered the most problematic species; the remaining species can either be avoided during site works. Standard biosecurity measures as outlined in section 11 will be implemented to ensure these species are not spread outside the works area.

5.1 Japanese Knotweed Locations

A. Numerous immature stands (ranging from 1x1m to 2x12m) and sapling plants of Japanese knotweed were recorded, at a scattered distribution, within a large section of a well-maintained amenity grassland strip, along the southern fringe of the R630 where a 1426m long rising main to convey Rostellan Formula ‘A’ flows to the Lower Aghada network is proposed (**Appendix 1, Photographs 1 to 6**). In addition, Japanese knotweed was also recorded within a shrub bed and treeline/coniferous woodland band/vegetated embankment both within and adjacent to this amenity grassland strip. A moderate sized stand of Japanese knotweed was also recorded growing within private property just east of aforementioned stands. Amenity grassland separates the R630 road from each stand/plant of Japanese knotweed, however the width of the amenity grassland ranges from approximately 1m to 13m. Therefore, during the excavation works for the pipeline, the root system of the Japanese knotweed stand could potentially be impacted. During the December 2019 site survey, it was noted that all Japanese Knotweed stands remained in place, with no apparent signs of treatment.

B. A dense mature stand, approximately 25m in length and 5m wide, runs along the eastern fringe of the R630 (**Appendix 1, Photographs 7 & 8**). The road at this point is approximately 6m wide with an additional grass/earth verge of 4m on the western side of the road. There is the potential that during the excavation works for the pipeline the root system of this Japanese knotweed stand may be impacted. During the December 2019 site survey, it was noted that this Japanese Knotweed stand remained in place, with no apparent signs of treatment.

C. A large stand of Japanese knotweed also exists where a laneway diverges from the R630 road (**Appendix 1, Photographs 9 & 10**). This is a large mature stand which has the potential to impact on the proposed works area i.e. section of the proposed 1765-metre-long rising main, which will be laid from the Whitegate PS to the proposed WwTP. During the December 2019 site survey, it was noted that this Japanese Knotweed stand remained in place, with no apparent signs of treatment.

D. A large dense stand of Japanese Knotweed approximately 20m in length and 5m wide was recorded growing on top of an embankment within an area used to store old construction material and cabins (**Appendix 1, Photographs 11 & 12**). This large contaminated area is located south and above (approx. 3-4m) an agricultural laneway in which it is proposed to lay a 1,765-metre-long rising main from the Whitegate PS to the proposed WwTP. It is unlikely that this large stand of Japanese knotweed will be impacted by the proposed development. During the December 2019 site survey, it was noted that this Japanese Knotweed stand remained in place, with no apparent signs of treatment.

E. A very large dense mature stand of Japanese knotweed was recorded growing along the western periphery of an agricultural field in close proximity to White Bay. The stand is roughly 200m in length and up to 20m at its widest. The land slopes steeply towards the bay through an area of scrub/dense bracken habitat and Japanese Knotweed occurs within this area (**Appendix 1, Photographs 13 & 16**). The final effluent gravity outfall has been routed away from this large mature stand, thus avoiding any disturbance to the stand or its underground root system. However, during the site visit in December 2019 it was noted that machinery had cleared a pathway through a section of the existing stand. As a result, numerous fragments of rhizomes have been spread via movement of machinery and the stockpiling of earth and vegetation along the public pathway leading to White Bay Beach. Scattered along the margins of the pathway, within the tracks of the machinery, are a large number of emerging Japanese knotweed shoots and abundant rhizome fragments. As a result, a section of the final effluent gravity outfall will dissect this new contaminated area thus leading to the potential for further spread of Japanese Knotweed (See **Photographs 19-21**).

5.2 Himalayan Knotweed Locations

A. A small stand of Himalayan Knotweed (approximately 3 x 2.5m) was recorded growing along the southern boundary of the proposed Lower Aghada WwPS site (**Appendix 1, Photographs 17 & 18**). This stand of Himalayan knotweed is situated on a small raised embankment, approximately 12m east of the entrance gate and 7m north of the R630 road verge. There is the possibility that this stand may be impacted by the proposed works.

B. A stand of Himalayan knotweed was noted growing within the large stand of Japanese knotweed as noted in **section 5.1 E** above. The final effluent gravity outfall has been routed away from this large stand, thus avoiding any disturbance to the stand or its underground root system.

N51˚50'38.2",
W008˚11'43.4" (7m*)
N51˚50'37.3",
W008˚11'45.7" (7m*)
N51˚50'37.3",
W008˚11'48.9" (7m*)
N51˚50'36.6",
W008˚11'53.0" (6m*)
N51˚50'37.7",
W008˚11'45.5" (6m*)
N51˚50'37.5",
W008˚11'46.1" (6m*)
N51˚50'37.1",
W008˚11'49.6" (7m*)

N51˚50'37.0", W008˚12'37.4"
(7m* - Himalayan knotweed)

N51˚48'57.5", W008˚14'16.9" (7m

Figure 1: Locations of Japanese knotweed & Himalayan knotweed along with GPS coordinates.

6. Characteristics of Japanese Knotweed & Himalayan Knotweed

Japanese knotweed is the most common knotweed species. There are however, a total of four species present in Ireland, namely Japanese knotweed *Fallopia japonica,* Giant knotweed *Fallopia sachalinensis,* Bohemian knotweed *Fallopia japonicus x bohemica* and Himalayan Knotweed *Persicaria wallichii*.

All of these knotweed species are considered invasive aliens and are listed under Regulations 49 and 50 of the European Communities (Birds and Natural Habitats) Regulations 2011. The same control measures apply to all of these species. Characteristics of these species are shown in **Figure 2**.

6.1 Japanese Knotweed (*Fallopia japonica*)

Introduced into Ireland in the early part of the 19th Century, Japanese Knotweed is a highly invasive herbaceous perennial which grows up to 3m tall. The leaves and stems die back during winter, but growth is extremely rapid during spring. It can grow on almost any substrate and has invaded semi-natural riparian habitats including riverbanks, roadside and railway verges, coastal habitats, disturbed ground and waste areas and gardens in both urban and rural landscapes in Ireland. From an ecological viewpoint, its early emergence, great height and density of stands combine to shade out and suppress native plants. It has been shown to reduce species diversity of invertebrate populations and is therefore likely to reduce the quality of ecosystems for amphibians, reptiles, birds and mammals, whose diets are largely composed of arthropods.

It grows extremely vigorously and can penetrate through small faults in tarmac and concrete and thus can damage footpaths, roads and flood defence structures. As it can survive in poor quality soils, including spoil, it often thrives in brownfield sites and in urban areas. The key features of the plant are summarised below:

- Produces fleshy red tinged asparagus like shoots when it first breaks through the ground in an established stand.
- Has large, heart or spade-shaped green leaves which are approximately the size of your hand.
- Has leaves arranged in a zig-zag pattern along the stem.
- Grows up to 3 metres in height.
- Yellow / cream flowers in late summer (Typically the start forming from late July onwards).
- Hollow bamboo like stems which have distinctive ring like nodules at regular intervals along it.
- Brown stem remain in winter once it has died back.
- Extensive rhizome system (roots) (7m radius x 3m depth approximately)
- Orange centred rhizome.
- Spread entirely via the movement of plant and rhizome fragments.

The plant has woody underground rhizomes which can extend 7m laterally from a parent plant. The leaves and stems die back during winter, but growth is extremely rapid during spring. The plants spread mainly through fragments of rhizomes -as little as 0.7g of material or the size of a small fingernail is sufficient-and through cut stems. Stem material cannot regenerate once it has dried, but rhizome material may be viable for up to 20 years in the soil. Thus, control of this species is very difficult.

The major issue with this species is its ability to disperse by plant fragments and to colonise and invade disturbed land. Japanese Knotweed can regenerate from less than 0.7g of rhizome. Stem material cannot regenerate once it has dried, but rhizome material may be viable for up to 20 years in the soil. During flood events fragments of rhizomes may be broken off and washed downstream establishing new populations. Vegetation management, landscaping and construction activities can disturb Japanese Knotweed and it may spread within or off site in the form of plant fragments in the soil load or on the tires of machinery and dumpsters, especially on machinery with tracks. Mowing or strimming can distribute fragments, which can then be carried along road corridors by wind or on the tires of vehicles including cars (see Wace, 1977; Wilcox, 1989) or downstream where they can further invade riparian vegetation. Thus, control of this species is therefore very difficult and requires a detailed non-native invasive species management plan (Invasive Species Ireland, 2015).

6.2 Himalayan knotweed (*Persicaria wallichii*)

Himalayan knotweed is a native of the Himalayas in the region from Afghanistan to south-west China. The species was originally introduced as an ornamental garden plant. It is a robust, rhizomatous, perennial, with thin bamboo like stems that can grow up to 2m in height. It flowers in late summer (August-September).

A very persistent and rapid grower, its upright stems and thin pointed leaves result in very dense coverage. It colonises roadsides, river banks, damp grasslands and waste ground, forming dense colonies that exclude native vegetation, alter natural ecosystems and are difficult to eradicate. Die back in the winter can leave areas vulnerable to erosion.

Reproduction is almost entirely vegetative, from either tiny fragments of rhizome, or small pieces of plant stem which contain as little as two stem nodes. Typically, it is spread by cutting machinery, passing traffic, flowing water and the deliberate dumping of garden waste. It is well adapted to colonising river bank habitats where bare soil may be left after a flood and it can then survive future flooding.

Figure 2. Leaves of Japanese knotweed on the top left. In the top right picture are (from left to right) leaves of Giant knotweed, Bohemian knotweed, Japanese knotweed and Himalayan knotweed. Below are the key identification features of Japanese Knotweed.

7. Literature on control of Japanese knotweed.

There is an extensive body of literature on control of this species including the *NRA Guidelines on The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads (2008)*, *Best Practice Management Guidelines Japanese knotweed Fallopia japonica (2008* prepared for NIEA and NPWS as part of Invasive Species Ireland. The most extensive guidelines are available from the UK including *Managing Japanese knotweed on development sites - The Knotweed Code of Practice produced by the Environmental Agency*. Appropriate methods are also outlined in *Irish Water guidelines, (Irish Water Report Information and Guidance Document on Japanese Knotweed Asset Strategy and Sustainability).*

8. Potential treatment procedures

A number of different methodologies are employed to treat Japanese Knotweed. These include the following:

- Herbicide treatment;
- Combined treatment methods;

- Excavation and Burial;
- Excavation and Bund Method;
- Excavation and Root Barrier Cell Method; and
- Removal of contaminated soil off-site.

9. Development of a management plan.

The following factors are considered when developing a management plan:

- Timeframe in which the work needs to be completed;
- Structural or environmental features that might affect control action, such as proximity to watercourses, designated sites;
- Future plans for the site, such as development or landscaping plans;
- Hazards or risks identified during the site inspection, such as underground services and chemical contamination;
- Availability of storage areas on or off site;
- Access for machinery through private residences;
- Agreement with landowners where a stand is partially within the works area and partially within the landholding of another person or entity;
- Seasonal restrictions to work;
- Commencement date for proposed works;
- Financial constraints;
- Location of underground services; and
- Site hygiene

10. Environmental Restrictions

Rivers, streams and estuaries provide particular issues with respect to Japanese Knotweed (including Himalayan Knotweed) treatment. During the excavation process, small fragments of rhizome or stem falling into a watercourse can lead to inadvertent spread of the plant downstream. The use of certain herbicides is restricted in proximity to water. It is noted that the spread of invasive species has the potential to impact on the Cork Harbour SPA which is a Natura 2000 site and thus is considered of particular sensitivity. This SPA could also be affected by inappropriate use of herbicides

11. Site hygiene

The following site hygiene protocols need to be put in place to prevent inadvertent spread of plant fragments during site investigations and during subsequent excavation and removal/treatment.

1. All biosecurity measures will be approved by the supervising ecologist prior to commencement of any works.

2. Ensure all site users are aware of measures to be taken and alert them to the presence of the Invasive Species Management Plan. Management of invasive species will be assigned to a nominated individual who will walk the entire works area with the supervising ecologist. In relation to knotweed species the information that the extent of the rhizome (root) system underground can extend up to 7m horizontally and 3 meters vertically must be clearly communicated

3. Prior to the commencement of works the works area will be resurveyed to accurately assess any changes in distribution in the intervening period.

4. All stands of Japanese Knotweed will be clearly delineated with hazard tape and fenced in a manner visible to machine operators prior to the commencement of works.

5. Appropriate signage will be put in place to deter any entrance by people or machinery into the areas within which the Japanese Knotweed is growing.

6. Prior notification will be given to all contractors that parts of the works area are contaminated with Japanese Knotweed and that they must adhere to this protocol to avoid the spread of the plant within and more importantly, outside of the works area. This includes any site investigation works in advance of commencement of excavation works.

7. Only vehicles required for the works within the contaminated works area will be brought on site and the number of visits minimised as much as practicable. Vehicle movements within this area swill be kept a minimum. It is noted that vehicles will only enter these areas under the supervision of the supervising ecologist.

8. At each location a specialised wash down area will be created for machinery and footwear. All machinery and equipment (including footwear) should be power washed prior to leaving the contaminated works area within this wash down area. They will also be visually checked for clods of soil, bits of vegetation etc. and particular care is required with tracked machinery.

9. This wash down area will be located in close proximity to existing stands and the wash down area will be included in the post-works treatment programme for Japanese Knotweed.

10. Ideally works including site investigation works should be undertaken in dry weather to minimise the potential for dispersal of fragments of invasive species.

11. A supervising ecologist will be present on site to identify pieces of Japanese Knotweed fragments and to determine the volume of spoil to be removed. In the case of mature stands, spoil from a 7m buffer around the parent plant may require removal.

12 The areas where contaminated soil is to be stockpiled will be clearly marked out on site. These areas will not be within 50m of the seashore or within a flood zone.

13. Any trucks used to transport spoil offsite must be sealed so that no fragments of material can escape on route. Vehicles leaving the site will be inspected for any plant material and washed down into a contained wash down area.

14. Vehicles used in the transport of contaminated material will need to be visually checked and washed down in the contained wash before being used for any other work, either on the same site or at a different site.

15. To prevent Japanese Knotweed from outside the site being inadvertently being brought in to the site, the contractor will be required to inspect vehicles before using them on site, and will pay particular attention to caterpillar tracks and where trucks and dumpers are stowed. The supplier of fill will be required to provide a guarantee that the fill to be imported does not contain knotweed. In addition, the fill will be inspected for signs of knotweed, prior to importation to site. The UK Environmental Agency's publication Managing Japanese knotweed on development sites - The Knotweed Code of Practice (EA 2013), states that inspection of topsoil brought into the site, should be carried out using the guidance in appendix I-IV of the code BS 3882:2007 'The British Standard Specification for topsoil and requirements for use'. This Standard was replaced subsequently by BS3882:2015 Specification for Topsoil. The inspection of fill will be carried out according to this Standard.

12. Japanese Knotweed treatment options

As noted, avoidance of excavation within 7m is the preferred option for existing stands outside the works area. A methodology for dealing with the stands within the works area has been identified and is discussed below.

If Japanese knotweed contaminated material is to be removed off site it will require a licence from the National Parks and Wildlife Service in advance of any removal, in accordance with the European Communities (Birds and Natural Habitats) Regulations 2011 (SI 477).

12.1 Trial investigations to quantify level of infestations

Prior to the commencement of works and utilising the information obtained by the invasive species surveys, a number of trial excavations around the perimeters of the knotweed clusters will be carried out. This will be completed before any excavation works to more exactly quantify the volume of contaminated material and will be carried out as follows:

- Trial excavations at Knotweed location at extent of 7m perimeter to verify the presence of viable rhizomes;
- Excavations to work towards the centre of each plant locus until live rhizomes are identified;
- Quantify the volume of contaminated material;
- All trial excavations will be competed in the presence of the appointed Ecologist; and
- All bio-security protocols as detailed above will be strictly adhered to.

12.2 In Situ Treatment Options

This option is the most easy to implement where time allows. Generally, if herbicide is applied as the treatment option, it will need to be reapplied for up to five years after the first application to ensure the plant control measures have been effective, or monitored for a minimum of 2 years during which no regrowth is recorded or where an ecologist has determined that no viable rhizomes or plants are present.

The appropriate methods for herbicide treatment area outlined in Irish Water guidelines, (Irish Water Report Information and Guidance Document on Japanese Knotweed Asset Strategy and Sustainability) and are summarized below:

Two herbicides Glyphosate and 2,4-D Amine can be utilised. The most effective time to apply Glyphosphate is from July to September (or before cold weather causes leaves to discolour and fall). The majority of herbicides are not effective during the winter dormant stage because they require living foliage to take up the active ingredient. It is essential that a competent and qualified person carries out the herbicide treatment in accordance with relevant legislation. Reapplication rates will depend on site specific considerations including the extent of the infestation, its location, and the time of year treatment commences.

Foliar Application

This type of treatment is usually applied with a sprayer. It is important to use a treatment dye to identify clearly all areas treated. It is an efficient way to treat large monocultures of invasive plants, or to spot-treat individual plants that are difficult to remove mechanically such as Japanese knotweed.

Depending on weather and temperatures in the days following the initial treatment, and to ensure optimal uptake of herbicide into the rhizome system, a second similar treatment is required usually within ten days, before the internal vascular system is no longer capable of

translocating the herbicide to the root system. It is also important to treat the leaf under surface as Japanese knotweed possesses many stomata openings on the leaf under surface. Dead stems are cut, removed and burned on site in accordance with the Waste Management Acts 1996 as amended and the Waste Management (Prohibition of Waste disposal by burning) Regulations 2009 (SI 286).

Stem Injection

This treatment requires a higher concentration of the active ingredient than is used in foliar applications. It involves the use of a specialist herbicide injection tool whereby the injection tool injects the herbicide directly into each of the canes approximately 20-30cms from the base of each cane (between the 1st and 2nd nodule). Subsequently approximately 10mls of herbicide mix is injected into each cane at a ratio of 5:1 through the use of a specialist stem injection tool. The application of glyphosate based products, are most effective when applied in the early Autumn (Mid to Late Sept).

If avoidance is not possible then in situ treatment with herbicides is the preferred option where there is sufficient time before the commencement of works and where impacts on adjoining terrestrial or aquatic habitats can be effectively managed.

12.3 Treatment options if herbicide application is precluded.

If there are very small amounts of Japanese Knotweed present it can be transferred with any contaminated spoil as determined by the supervising ecologist to a licensed facility for disposal.

12.3.1 Excavation and removal off-site

This is considered an appropriate method where relatively small volumes of soil need to be dealt with. This method requires extraction of the infested soil and removal off-site. Following a determination of the extent of infestation by the supervising ecologist, infested material can be removed by excavator, transferred to a dumpster and will be temporarily stored on heavy duty polythene (1200 gauge) which will be turned up around the perimeter to form a bund inside temporary fencing, in advance of removal off site. Work will not be carried out during weather. Material will be loaded on to a lorry, which is adequately sealed, from this temporary storage area All machinery will be operated in such a manner so as to prevent further dispersal of vector material within the site during recovery works.

All site hygiene methods as outlined above in section 11 will be implemented. The material can then be transported under licence to a licenced facility/landfill for appropriate disposal. This work must be carried out under the supervision of the supervising ecologist who will also provide a tool box talk prior to the commencement of works. As this method creates the risk of inadvertent spread of rhizome fragments the supervising ecologist will work with the contractor to provide a detailed method statement as part of a detailed invasive species management plan based on up to date data.

3. Preventing Further Spread

Following the removal of Japanese knotweed from the works area, a root protection barrier will be put in place along lengths of pipeline in proximity to infested areas to inhibit further IAS invasion from adjacent established stands. The risk of Japanese knotweed spreading from any remaining growth outside the works area is high and preventing re-infestation is considered a high priority.

It is noted that careful planning of site works and strict adherence to hygiene protocols as outlined above will be required to prevent spread of Japanese knotweed or re-infestation of areas from which it has been eradicated. It is noted that Japanese knotweed is highly invasive and therefore the distribution of this species can change dramatically within a relatively narrow timeframe. It is imperative therefore that the implementation of a management plan is based on up to date survey data and this management plan may need to be modified or altered by the supervising ecologist when up to date data is available.

14. Evaluation

The effectiveness of the invasive species control programme will be evaluated to ensure the following key objectives have been achieved:

- No dispersal of Japanese Knotweed or Himalayan Knotweed off-site.
- Japanese Knotweed has been eliminated as a risk to the proposed works.
- Works can proceed without the disturbance of Japanese Knotweed.
- All pipelines are intact and will not be impacted by invasive species.
- Irish Water has liaised with Cork County Council to eradicate Japanese Knotweed from within and adjacent to the works area.
- No impacts on the Cork Harbour SPA from the spread of invasive species or the implementation of control measures for invasive species has occurred.

This evaluation will be carried out by the supervising ecologist prior to the completion of site works. Where required to address issues that remain outstanding the supervising ecologist will modify the methodology or specify additional methods. The revision of the plan will be sent to Irish Water for review. It is noted that additional measures are available to treat Japanese Knotweed including deep burial and bund/treatment method. If is considered necessary to implement these measures all site hygiene measures as specified in this report will be implemented.

15. Conclusions

Japanese Knotweed and Himalayan knotweed were recorded at various locations within the study area.

It is noted that small fragments of Japanese knotweed and Himalayan knotweed rhizome and stem can result in new stands becoming established and this is a particular risk in respect of waterways or coastal water bodies where fragments can drift downstream or be taken by tidal cycles into new areas.

The route has been designed to avoid the largest area of Japanese Knotweed/Himalayan knotweed at White Bay and standard measures will be implemented to ensure there is no spread of this species from stands located in other areas

A buffer zone of seven metres will be put in place in respect of each stand of Japanese Knotweed were possible. This zone will be clearly fenced and no works will proceed within these buffer zones. The extent of the infestation will be determined by the supervising ecologist.

The various control methods which can be utilised are outlined above and, in all cases, should be based on up to date data. The appropriate methodology to be employed by the contractor can then be identified and implemented via an up to date, site specific update of this Invasive Species Management Plan. A suitably qualified invasive species specialist will be engaged to update this invasive species management plan and to undertake the appropriate treatment.

16. References

Environment Agency (UK) 2013 Managing Japanese knotweed on development sites - The Knotweed Code of Practice.

Invasive Species Ireland (2015). Best Practice Management Guidelines Japanese knotweed *Fallopia japonica*.

NRA (2010) Guidelines on The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads

Wace, Nigel. 1977. Assessment of dispersal of plant species - the car-borne flora in Canberra. Proc. Ecol. Soc. Austr. 10: 167-186.

Appendix 1

Photographs 1 – 6: Japanese knotweed growing along the southern fringe of the R630 where a 1,417m long rising main to convey Rostellan Formula 'A' flows to the Lower Aghada network is proposed. Japanese knotweed within an amenity grassland strip.

Photographs 7 & 8: Large Japanese knotweed stand growing along eastern fringe of the regional road R630.

Photographs 9 & 10 showing large mature stand of Japanese knotweed where proposed route of the rising main diverges from the R630 to the laneway.

Photographs 11 & 12 Japanese knotweed growing on top of an embankment within an area used to store old construction material and cabins.

Photographs 13 & 16 showing large mature stand of Japanese knotweed in proximity to White Bay. Note – Small stand of Himalayan knotweed recorded growing within stands of Japanese knotweed.

Photographs 17 & 18 A small stand of Himalayan Knotweed recorded growing along the southern boundary of the proposed Lower Aghada WwPS site.

Photograph 19 showing cleared area within existing stand of JKW

Figure 20 showing tracks from machinery along sides of track to White Bay beach where new growth of JKW is now evident.

Photograph 21 showing rhizome of JKW and regrowth