Appendix 6-6 – Invasive Species Management Plan

TOBIN
CONSULTING ENGINEERS
BUILT ON KNOWLEDGE

Cloghercor Wind Farm Ltd.

Cloghercor Wind Farm

Invasive Species Management Plan Report

February 2023

Cloghercor Wind Farm

Invasive Species Management Plan Report

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TOBIN Consulting Engineers

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1 INTRODUCTION

1.1 PROJECT BACKGROUND

This Invasive Species Management Plan (ISMP) report has been prepared by TOBIN Consulting Engineers (TOBIN) on behalf of Cloghercor Wind Farm Ltd. for the proposed Cloghercor Wind Farm, (herein referred to as the proposed development), located in the townlands of Cloghercor, Co. Donegal.

It proposed development aims to supply power from the Cloghercor Wind Farm to the Irish electricity network via loop-in 110kV underground cables (approximately 4.01km cable length within approximately 3.36km of internal access roads) to the existing overhead 110kV power line in the townland of Cloghercor, Co. Donegal.

During habitat surveys undertaken by TOBIN ecologists, two invasive species plants- Rhododendron (*Rhododendron ponticum)* and Japanese knotweed (*Reynoutria japonica*), were identified within the proposed development site boundary. This ISMP was therefore prepared to provide Cloghercor Wind Farm Ltd. and the appointed contractor with a sufficiently detailed account of the control and management measures required to eradicated and precent the further spread of invasive species during the course of the proposed development works. This ISMP describes the strategy that will be adopted during the construction and operation of the proposed development to manage the presence of Rhododendron and Japanese knotweed within the site and reduce the risk of spreading these species further throughout the site.

The objectives of this ISMP are:

- Objective 1- To prevent the further spread of the invasive species to areas off-site.
- Objective 2- To prevent the further spread of the invasive species within the site.
- Objective 3- To completely eradicate the invasive species within the site.

This ISMP is a working document. Following the appointment of the contractor, and prior to the commencing works on site, the ISMP will be further developed by the contractor.

1.2 LEGISLATIVE BACKGROUND

The definition of invasive species as prescribed by the Convention on Biological Diversity (CBD)[1] is*; "species whose introduction and/or spread outside their natural past or present distribution threatens biological diversity"*. Invasive species are found in all taxonomic groups including animals, plants, fungi and microorganisms and can affect both terrestrial and aquatic ecosystems around the world. Invasive species can be classified as High Impact Species[2] or Medium Impact Species[3].

The control of invasive species in Ireland comes under the Wildlife (Amendment) Act 2000, where it states that *'Any person who plants or otherwise causes to grow in a wild state in any place in the State any species of flora, or the flowers, roots, seeds or spores of flora, otherwise than under and in accordance with a licence granted in that behalf by the Minister shall be guilty of an offence.'* The Birds and Natural Habitats Regulations 2011 (SI 477 of 2011), Section 49(2) prohibits the introduction and dispersal of species listed in the Third Schedule, which includes

[1] Invasive Alien Species (cbd.int)
[2] Species Profile Browser · Species Profile (biodiversityireland.ie)
[3] Species Profile Browser · Species Profile (biodiversityireland.ie)

Rhododendron and Japanese Knotweed, as follows: *"any person who plants, disperses, allows or causes to disperse, spreads or otherwise causes to grow shall be guilty of an offence".*

The key aim of the invasive species survey was to identify species of High and Medium risk including those listed on the Third Schedule, Part 1, of the European Communities (Birds and Natural Habitats) Regulations 2011, S.I. No. 477/2011 (commonly referred to as the Birds and Habitats Regulations), which may occur in the vicinity of the proposed development.

Ireland has ratified a number of treaties and conventions, including the Convention on Biological Diversity, under which Ireland is obligated to address issues on Biological Diversity, including invasive alien species. Through various pieces of legislation including the Wildlife Acts 1976 (as amended) and the Birds and Natural Habitats Regulations, Ireland sets out legal implications associated with invasive alien species.

Articles 49 and 50 of the Habitat Regulations details the legal requirements for the control of alien invasive species. Under Article 49 and 50 of these regulations, it is an offence to:

- Plant, disperse, allow or cause to disperse, or grow any plant listed in Part 1 of the Third Schedule (i.e. High Impact Species);
- Possess the plant or any component of the plant for sale, reproduction, propagation, transportation, distribution, introduction or release any plant listed in Part 1 of the Third Schedule;
- Import or transport any plant listed in Part 1 of the Third Schedule; and/or
- Possess any vector material (e.g. soil, plant material) for the purposes of breeding, sale, distribution, introduction or release as listed in Part 3 of the Third Schedule.

Note, licences may be granted for certain activities associated with invasive species.

High Impact Species

These include species designated as high-risk species recorded in Ireland and those listed on the Third Schedule, Part 1 of the Birds and Habitats Regulations (2011)[4].

Medium Impact Species

Medium risk species include those that are amber listed by Invasive species Ireland and are identified as those species that, under the right ecological conditions, may have an impact on the conservation goals of a site or impact on a water body achieving good/high ecological status under the Water Framework Directive. Additionally, medium impact species include those that are assessed as having a risk score of between 14-17 in a risk prioritization study, undertaken for invasive and non-native species on the Island of Ireland (Kelly *et al.*, 2013).

1.3 METHODOLOGY

This plan applies the most relevant and current guidance in relation to the treatment and management of invasive plant species in construction projects. The following guidance was referred to in preparation of this plan.

[4] S.I. No. 477/2011 - European Communities (Birds and Natural Habitats) Regulations 2011. (irishstatutebook.ie)

- Transport Infrastructure Ireland (TII) (2020) The Management of Invasive Alien Plant Species on National Roads – Technical Guidance;
- Chapter 7 and Appendix 3 of the TII Publication: The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads (NRA, 2010);
- IW-AMP-SOP-009 Information and Guidance Document on Japanese knotweed;
- Best Practice and Management Guidelines for Japanese knotweed (Invasive Species Ireland, 2015);
- Best Practice and Management Guidelines for Rhododendron and Cherry Laurel (Invasive Species Ireland, 2008); and
- Circular Letter NPWS 2/08 Use of Herbicide Spray on Vegetated Road Verges (National Parks and Wildlife Service 2008).

2 PROPOSED DEVELOPMENT SITE

2.1 DESCRIPTION OF THE EXISTING ENVIRONMENT

Within the proposed development, a variety of habitats exists which will be directly impacted, removed or fragmented by the proposed development. The main habitats within the proposed development site were identified and classified according to Fossitt (2000). These included: conifer plantations (WD4), dense bracken (HD1), lowland blanket bog (PB3), wet grassland (GS4), buildings and artificial surfaces (BL1), eroding/upland rivers (FW1) and drainage ditches (FW4) were also recorded within the boundary of the site.

No Annex I habitats were recorded within or in the immediate vicinity of the site. Across the mountain itself there are two watercourses, the Mulnamin Beg_010 (waterbody code: IE_NW_38M290990) and Glenleheen stream_010 (waterbody code: IE_NW_38G070300). These water courses are part of the Gweebarra_SC_010 subcatchment.

The majority of these are small order streams and rivers of Mulnamin Beg_010 which spans across the proposed development site and also a large number surrounding it. All of these waters are categorised as FW1 Eroding/Upland Rivers (Fossit, 2000). The Glenleheen stream_010 is located on the south west of the mountain which flows into the Gweebarra River (Gweebarra_020) before it also enters into the Gweebarra Estuary. One stream of the Glenleheen stream_010 is located within the proposed development.

2.2 DESCRIPTION OF THE PROPOSED DEVELOPMENT

A summary of the overall proposed project is as follows:

- Erection of 19 no. wind turbines with an overall blade tip height range from 185m to 200m, a rotor diameter range from 149m to 164m, a hub height range from 112m to 125m, and all associated foundations and hard-standing areas in respect of each turbine;
- Construction of new site entrance with access onto the L6483 local road for the construction phase (operational phase maintenance traffic only), and utilisation of a

permitted forest entrance (Pl. Ref. 1951040) to the L6483 as a second construction phase site access point. A third site entrance on the L6483 will form the operational phase public entrance to the wind farm;

- Improvements and temporary modifications to 5 no. locations adjacent to the public road to facilitate delivery of abnormal loads and turbine delivery on the R262 and N56 in the townlands of Tullycumber, Drumard, Darney, Cashelreagh Glebe and Aghayeevoge;
- Construction of an area of temporary hard standing to function as a blade transfer area to facilitate turbine delivery on the R262 in the townland of Drumnacross;
- Widening of sections of the L6363 and L6483 within the road corridor (up to 4.5m running width) to facilitate delivery of abnormal loads/turbines in the townlands of Cloghercor, Shallogan More, Derryloaghan and Straboy;
- Construction of 2 no. temporary construction compounds with associated temporary site offices, parking areas and security fencing;
- Installation of 1 no. permanent meteorological mast with a height of 100m;
- 4 no. borrow pits;
- Construction of new internal site access roads and upgrade of existing site roads, to include passing bays and all associated drainage;
- Construction of drainage and sediment control systems;
- Construction of 1 no. permanent 110kV electrical substation including:
    - 1 no. EirGrid control building containing worker welfare facilities and equipment store;
    - 1 no. Independent Power Producer (IPP) control building containing HV switch room, site offices, kitchen facilities, storeroom and toilet amenities.
    - All electrical plant and infrastructure and grid ancillary services equipment;
    - Parking;
    - Lighting;
    - Security Fencing;
    - Wastewater holding tank;
    - Rainwater harvesting equipment;
    - All associated infrastructure and services including site works and signage;
- All associated underground electrical and communications cabling connecting the wind turbines to the proposed wind farm substation;

- All works associated with the connection of the proposed wind farm to the national electricity grid, which will be via a loop-in 110 kV underground cable connection (approximately 4.1km cable length within trenches on approximately 3.36km of internal access roads) to the existing 110kV overhead line in the townland of Cloghercor, Co. Donegal, with two new 16m and 21m high steel lattice end masts at each interface;

- Removal of 26no. existing wooden polesets and 1no. Steel lattice angle mast between the two new interface end masts;

- 2 no. watercourse (stream) crossings on the grid connection route;

- All related site works and ancillary development including berms, landscaping, and soil excavation;

- Forestry felling to facilitate construction and operation of the proposed development and any onsite forestry replanting;

- Development of a permanent public car park with seating/picnic tables at the end of the construction phase of the development at the location where the proposed grid connection intersects the L6483;

- Permanent recreational facilities including marked walking trails along the site access roads and paths, and associated recreation and amenity signage; and

- Approximately 252ha of biodiversity enhancement lands located over 3km from the proposed wind turbines.

A 10-year planning permission and 35-year operational life from the date of commissioning of the entire wind farm is being sought.

2.3 FIELD SURVEY

2.3.1 Survey Methods

The invasive species survey was undertaken by TOBIN Ecologist John Sherry between the 20th-23rd of September 2021. The survey was undertaken carried in order to assess the existing environment, to identify and verify the presence of non-native species of High[5] and Medium[6] risk including those listed in the Third Schedule of S.I. No. 477 of 2011, EC (Birds and Natural Habitats) Regulations 2011, and establish the distribution of these species within the site.

No standard method exists for an invasive plant species survey, and the survey was based on an ecological walkover survey approach, whereby all accessible areas of the survey site were walked by the surveyor in daylight hours, with a visual search for the target species undertaken.

Identification of all invasive species was undertaken within the optimal botanical survey season. The timing of the invasive species survey meant that the presence of Third Schedule species were not missed as the vegetative parts of the plants (growing above ground) can be absent during the colder months of the year, with the plant persisting, over winter, below ground as rhizomes or lying dormant in the seed bank.

[5] Invasives_taggedlist_website_pdfs.xls (biodiversityireland.ie)
[6] Invasives_taggedlist_website_pdfs.xls (biodiversityireland.ie)

Any non-native species of High and Medium risk, including those listed in the Third Schedule, were identified and their location recorded onsite. A distribution map containing the presence and extent of invasive species recorded within the proposed development site was then created.

2.3.2 Survey Results

Two high impact invasive plant species, were identified within the proposed development site Rhododendron and Japanese knotweed (see Plate 2-1 and Plate 2-2). Both of these species are listed in Part 1 of the Third Schedule of S.I No. 477 of 2011, European Communities (Birds and Natural Habitats) Regulations 2011 and the IAS Regulations.

Rhododendron was found throughout the proposed development site, generally in groups of 1-2 plants with some areas of larger infestations also present. Plant heights ranged from 0.5m-1.5m, the majority of plants found were young saplings and range from young saplings to fully grown shrubs.

Plate 2-1 Large Rhododendron Bush Located Within the Proposed Development Site

Japanese knotweed was recorded towards the north-east of the proposed development site in at two locations, within the conifer plantation (WD4) and dry calcareous heath (HH2) habitats. The Japanese knotweed plants were found to be fully mature and in flower. The area of infestation was approximately 3m in height and 6m x5m in dimension.

Plate 2-2 Japanese Knotweed Located within the Proposed Development Site

A third invasive species, Montbretia (*Crocosmia X crocosmiflora*) was also recorded in two areas toward the west of the proposed development, however, this plant is not listed on the Third Schedule. Therefore it is not illegal to disturb or cause the dispersal or spread of this plant. As a result, this species will not require a management plan.

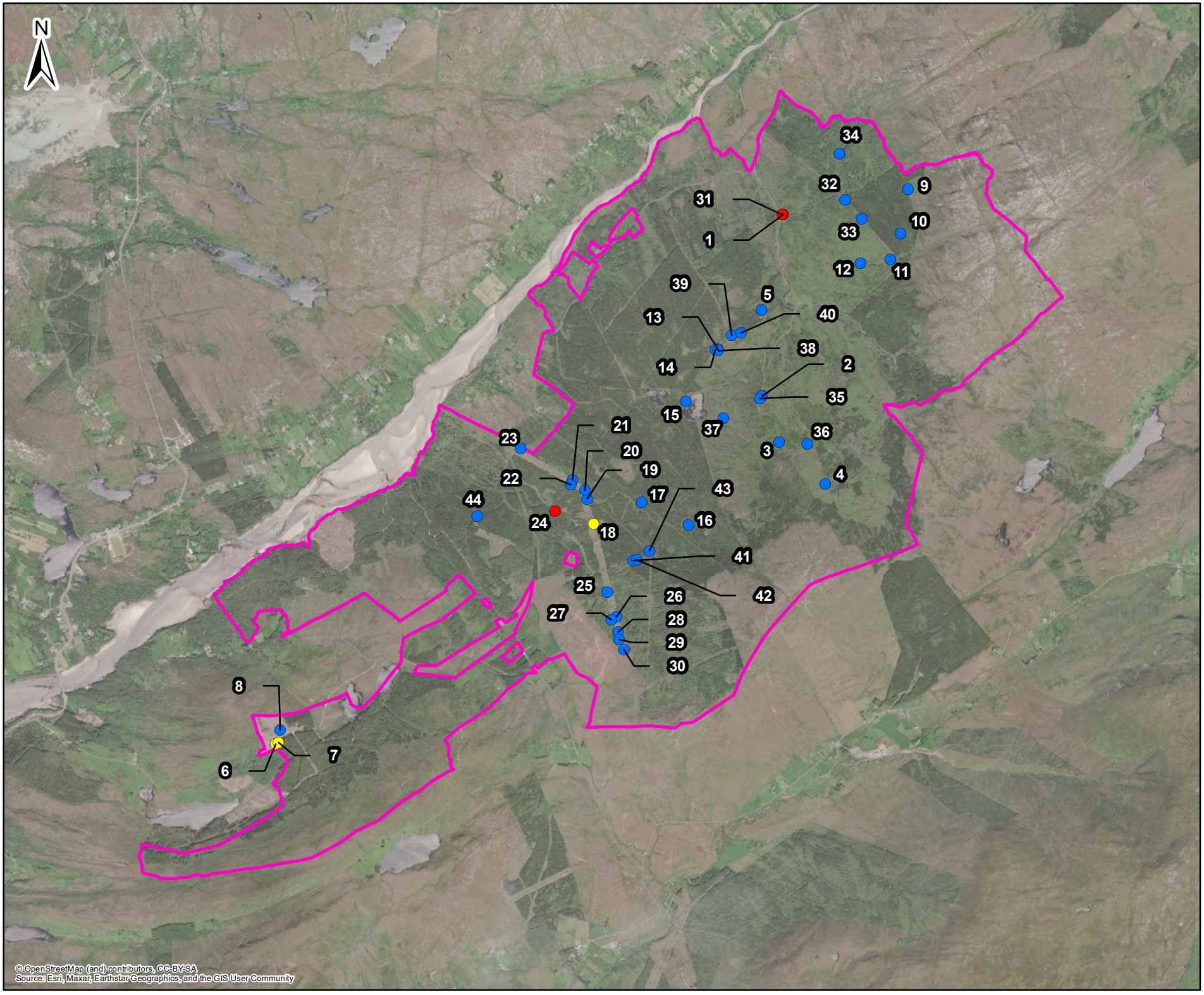
The co-ordinates and abundance of invasive species found within the proposed development site are presented in, and the distribution of the invasive species within the proposed development site is mapped in Figure 2-1

Table 2-1 Locations and Abundance of Invasive Species within the Proposed Development Site

Invasive species point I.D	Species	Co-ordinates	Abundance and Description
1	Japanese knotweed	585736.9,903412	One large area with multiple stands of Japanese knotweed (ca. 3m in height, 6mx5m in diameter) was recorded at this location.
2	Rhododendron	585591,901382	One semi-mature bush and one smaller sapling of Rhododendron were recorded at this location. The larger shrub was observed to be growing across the access track.
3	Rhododendron	586325,899943	One semi-mature shrub was recorded at this location, within conifer plantation (WD4) habitat.
4	Rhododendron	586569,899951	One semi mature shrub, located at the edge of the conifer plantation (WD4) habitat, was observed to be in the post-flowering phase and producing some seeds.
5	Rhododendron	585773.6,902677	One single immature plant was recorded at this location.
6	Montbretia	581790,898978	One plant was recorded growing in wet heath (HH3) at this location, along the power line route.
7	Montbretia	581861,899005	One small patch of montbretia was found growing along the road's edge, at this location.
8	Rhododendron	583448,900990	A number of small plants were found at this location, along the edge of the forest road.
9	Rhododendron	586713,902702	One single plant, ca. 0.5m high was recorded at this location.
10	Rhododendron	586333,902671	One small plant was recorded here within dense forestry.
11	Rhododendron	586055,902898	One small seedling was recorded at this location.
12	Rhododendron	586642,902669	One single plant, ca. 1m high, was recorded at this location.
13	Rhododendron	585666,901791	One large shrub and 12 smaller plants were recorded at this location, the infestation appeared to be rapidly spreading here.
14	Rhododendron	585003,901797	One large shrub was found to be producing seeds at this location.
15	Rhododendron	584980,901397	One large shrub was recorded at this location.

Invasive species point I.D	Species	Co-ordinates	Abundance and Description
16	Rhododendron	585979,901429	One large shrub and one smaller sapling were recorded at this location, the larger shrub was found to be producing seeds.
17	Rhododendron	585033,901524	One semi-mature shrub was found to be producing seeds at this location.
18	Rhododendron	585104,901006	Two young plants were recorded growing in wet heath along the power line route.
19	Rhododendron	584726,900380	Two young plants were recorded at this location, both were 1m high.
20	Rhododendron	585079,900380	One young plant was recorded at this location.
21	Rhododendron	584496,900842	One young plant was recorded at this location.
22	Rhododendron	585021,900380	One young plant was recorded at this location.
23	Rhododendron	584102,900860	One young plant was recorded at this location.
24	Rhododendron	584728,900111	One young plant was recorded at this location.
25	Rhododendron	584812,899655	One young plant was recorded at this location.
26	Rhododendron	584389,900110	One young plant was recorded at this location.
27	Rhododendron	584811,900458	Two shrubs were recorded at this location .
28	Rhododendron	584311,899411	Two shrubs were recorded at this location.
29	Rhododendron	584166,899411	Multiple shrubs and saplings were recorded at this location.
30	Rhododendron	584305,899403	Multiple shrubs and saplings were recorded at this location.
31	Japanese knotweed	585806.0,903442	One large area of Japanese knotweed, ca. 8x8m in diameter was recorded at this location.
32	Rhododendron	586600,900568	One young plant was recorded at this location.
33	Rhododendron	586788,903255	One young plant was recorded at this location.
34	Rhododendron	586724,904252	One young plant was recorded at this location.
35	Rhododendron	586486,901816	One shrub and one sapling were recorded at this location.
36	Rhododendron	586597,899954	One young plant was recorded at this location.
37	Rhododendron	585668,901889	One young plant was recorded at this location.
38	Rhododendron	585199.2,902404	One shrub and a number of saplings were recorded at this location.
39	Rhododendron	585627,901795	One young plant was recorded this location
40	Rhododendron	585579,901787	One young plant was recorded this location

Invasive species point I.D	Species	Co-ordinates	Abundance and Description
41	Rhododendron	584628.2,900814	One young plant was recorded this location
42	Rhododendron	584493.9,900558	One young plant was recorded this location
43	Rhododendron	584735,900238	One young plant was recorded this location
44	Rhododendron	585207,897040	One young plant was recorded this location



Legend

Proposed Wind Farm Site Boundary

Invasive Species

- Japanese Knotweed
- Montbretia
- Rhododendron

0 0.25 0.5 0.75 1

Kilometres

NOTES

1. FIGURED DIMENSIONS ONLY TO BE TAKEN FROM THIS DRAWING
2. ALL DRAWINGS TO BE CHECKED BY THE CONTRACTOR ON SITE
3. ENGINEER TO BE INFORMED OF ANY DISCREPANCIES BEFORE ANY WORK COMMENCES
4. ALL LEVELS RELATE TO ORDNANCE SURVEY DATUM AT MALIN HEAD

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Client:
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Project:
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Title:
Figure 2-1 Distribution of Invasive Non-Native Plant Species

Scale @ A4: 1:40,000

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Date: February 2023

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3 BACKGROUND TO MANAGEMENT OF RHODODENDRON

3.1 DESCRIPTION

Rhododendron is a large perennial evergreen, which was introduced to Ireland's parks and gardens during the 18th Century as an ornamental garden plant. There are over 900 species of Rhododendron, but only *Rhododendron ponticum* is invasive in Ireland.

Since its introduction, Rhododendron has escaped into the wild and is particularly invasive in the west, north-west and south-west of the country. Rhododendron thrives on acidic soil in areas with mild, moist climatic conditions. It is mainly found in mixed deciduous forests, temperate heaths and raised and blanket bogs. Rhododendron is an aggressive coloniser which is both environmentally and ecologically damaging to infected sites. It can also colonise a range of habitats including agricultural land, grasslands, woodland, urban areas, roadsides and wasteland.

This species can spread by both sexually (seed dispersal) and asexually (vegetative) means. Between May and July, it produces clusters of mauve-purple, bell shaped flowers with 3,000 to 7,000 wind-dispersed seeds produced per flowerhead. The seeds are dispersed in Feb-Mar and can be travel up to 100m by wind. These seeds can remain viable for several years. Rhododendron seeds are amongst the smallest and lightest of any plant species and are therefore designed primarily for wind dispersal. Rhododendron is also capable of reproducing by vegetative means, both by suckering from roots and by layering wherever branches touch the ground. In Ireland, colonisation takes place mainly through seed dispersal. The leaves, flowers and nectar of Rhododendron produce a chemical which makes it unpalatable to large herbivores and insect life, resulting in further increased rates of survival, explaining this species' successful spread throughout our native habitats. Once established, the individual plant forms dense, long-lived thickets which smother the ground flora and suppress the regeneration of native trees and shrubs. This allows the species to out-compete native plants for space and resources, especially for sunlight. Individual shrubs reach several metres in height. Well established thickets eventually form a toxic layer of leaf litter which produces a dark sterile environment and give little in terms of support for wildlife. The foliage of Rhododendron is unpalatable to grazing animals. It has been demonstrated that the diversity of bird life is also negatively affected in areas where large numbers of Rhododendron are present. Dense tangles of Rhododendron stems can block pathways, smother watercourses and encroach on roadways. Rhododendron can also prevent access to sites by the shear mass of plant material blocking paths.

3.2 IDENTIFICATION

Rhododendron forms a compact shrub in open areas, whereas in the shade it adopts a larger lateral spread. The leaves of the Rhododendron are waxy and oval shaped, the upper side of the leaf is dark green in colour, while the underside is paler and hairless. The leaves tend to be 10-20cm long and range in width from 2-6cm, and stems attached are usually 1-3cm long. This species is recognised by its distinctive, attractive flowers, carrying between pink, lilac and light/dark purple, spotted with brown and orange. These flowers are bell-shaped and arranged in clusters. However, a plant usually does not produce flowers until it reaches 10-12 years old. Mature plants can reach a height of up to 8m.

3.3 CHOSING AN APPROPRIATE METHOD

Rhododendron is an invasive species which may take several years to eradicate from a site. Non-chemical treatment, chemical treatment or a combination of both can be employed to control an infestation. Younger plants in newly established infected sites can be readily hand-pulled. Mature plants can be mechanically uprooted as the root system of Rhododendron is generally located in the top 45cm of the soil. Rhododendron re-grows vigorously when cut. Seeds are tiny and can be spread unintentionally on shoes, clothes and machinery. Regular and systematic follow-up is required to deal with re-growth and seedling germination, irrespective of the control method employed. In order for eradication projects to be successful, oldest bushes should first be treated in order to reduce seed dispersal.

The management and eradication of Rhododendron is challenging. Understanding the ecology of the species and carefully planning clearance work will ensure success. Clearance can be expensive, time consuming and should be well planned before any action is taken.

Different treatment methods may be required for different plant stands due to proximity to watercourses, proposed development area or the age of the plant and risk of continual spread/seed dispersal. Additionally stands can be split into those that require immediate removal and those that can be treated at a later stage. The most efficient methods of controlling Rhododendron depends on the size and life-stage of the stand. In general, stem treatment is most effective. Spray drift on non-target species or contamination of watercourses is a cause for concern if not appropriately applied.

Three main issues must be considered when planning management/control. These are:

- Rhododendron in Ireland is a prolific seed producer. However, a naturally seeded plant does not flower and produce seed until at least 10-12 years old. This provides a window of opportunity to prevent serious infestation, through the immediate removal of young plants.
- Rhododendron regrows vigorously when cut. As a result, some method of stump killing or removal is always necessary. Any untreated cut stump will regrow and in most cases flower within 3-4 years.
- The scale and nature of the site infestation.

3.3.1 Management Options

Management options to eradicate Rhododendron from the proposed development site were determined with reference to the NRA (2010) Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads Guidelines and are discussed hereunder.

Rhododendron management programmes can be divided into three categories- Mechanical Treatment of Rhododendron, Chemical Treatment of Rhododendron and Excavation and Waste Disposal. The following treatment options have been widely tested and measured for effectiveness across Ireland. In almost all cases, failures can be accredited to poor application of a particular technique and/or logistical difficulties, rather than the control method itself. Care should be taken when embarking on a control programme and resources should be identified and allocated for repeated treatments. In all treatment methods discussed herein, follow up treatment and monitoring are required.

3.3.2 Mechanical Treatment of Rhododendron

The use of mechanical or physical control on sites is generally only appropriate on sites of low ecological interest, due to the resulting damage to existing vegetation and soil disturbance. The area within the proposed development site is of low ecological interest, therefore, mechanical treatment is deemed appropriate.

3.3.2.1 Option 1- Cutting Stems

Cutting of stems by manual means of control has been widely used across in Ireland, the UK and Turkey, but on its own has been proven to be ineffective (TII, 2010). The plants ability to regenerate by suckers from remaining fragments of root or stem renders the cutting ineffective on its own, unless applied in areas of limited infection. This approach can be carried out anytime of the year on stems greater than 3cm, however it is labour intensive and expensive. Regular follow-up is required to deal with re-growth.

3.3.2.2 Option 2-Chainsaw Cutting of Root-ball

Chainsaw cutting of the root-ball is effective on larger plants and is more suitable for soft-soil areas. This approach is suitable to be used in combination with winching methods to reduce the level of disturbance. However, this option requires skilled operators and can cause significant wear and tear on equipment.

3.3.2.3 Option 3- Uprooting by Hand

Uprooting of plants allows for more effective control of the invasive Rhododendron as it provides better results and is more cost effective in the long run. The roots of this plant are relatively shallow, confined to the upper horizon of the soil. Younger plants can be easily hand-pulled.

3.3.2.4 Option 4- Uprooting by Tractor

Uprooting by machinery is also a more effective measure of control of Rhododendron than cutting due to better results and cost effectivity. This allows for more established plants to be toppled, however this method is more labour intensive and requires suitable anchor points or tractor access points to the site. The effectiveness of this technique is increased by removing all viable roots. To avoid regrowth after the initial cut and removal, stumps should be turned upside down and soil should be brushed off roots. This option may also not be suitable on sensitive sites due to the resulting soil disturbance, sediment run-off and nutrient leaching which could impact watercourses. This can be carried out at any time of the year.

3.3.2.5 Follow-up Treatments after Mechanical Treatment

1.Bud-Rubbing

An optional follow-up treatment to the cutting method is bud rubbing. This method is relatively new and experimental and is therefore still under investigation where, following the cutting back of the plant to a low stump, the re-growth of the plant is removed by hand or using a thin metal rod on a periodic basis. The timing of repeated visits is important in order to prevent the re-growth from re-establishing.

2. Mulch-Matting

This is relatively novel method of preventing re-growth following initial treatment. This method involves the application of heavy-duty geotextile directly over the cleared ground or over removed stumps and other materials to prevent re-generation of treated plants. This method reduces soil disturbance but can result in high costs.

3.3.3 Chemical Treatment of Rhododendron

Rhododendron is notoriously difficult to kill with herbicides and repeated application at low rates could be required as means of controlling growth and spread (NRA, 2010). Glyphosate (20% solution), tryclopyr (8% solution) or ammonium sulphate (40% solution) are known to be effective during suitable weather conditions i.e. dry weather.

If herbicides are to be used in any water catchment area where there is a risk of water contamination contact should be made with the local authority in advance of works. It is recommended that, where applications are made within 10m of a permanent water course or 20m of standing water, only a glyphosate-based product with no hazard rating for aquatic life (if in doubt check the product label) should be used. The method of application will have an impact on risk of water contamination – correctly managed stem treatment is likely to have less risk of run-off than other methods.

The herbicide concentrations used and timings of applications vary according to which chemical is used. Always read the label and follow the manufacturers guidelines when using herbicides.

3.3.3.1 Option 1 Cut-Stump Treatment

Once the woody stands of Rhododendron have been removed as above, re-growth from the stump can be controlled by treating the cut stem with a herbicide solution. Recently cut stumps should be painted or spot sprayed with the chosen herbicide. The stem or stump should be directly treated, ideally immediately after being cut, but no later than 48 hours. The quantity of herbicide to be used on stumps is shown in Table 3-1.

Use of a vegetable dye is recommended to mark the treated stumps and all stumps should be targeted, this will avoid missing or double treating stumps. A handheld applicator will help avoid spray drift onto surrounding non-target species. A follow-up foliar spray treatment should be applied when the regrowth reaches about 1m in height.

3.3.3.2 Option 2 Stem Injection

A variation on the stump treatment method is stem injection, using a 'drill and drop' methodology, whereby, if the main stem is cut and is large enough for a hole to be drilled into it, the hole can be used to facilitate the targeted application of glyphosate (25% solution). Holes of 11-16mm are drilled diagonally downwards every 7.5cm around the trunk as close to the ground as possible. 2ml of herbicide should be applied per stem immediately after drilling.

The advantages of this form of treatment leads to the reduced likelihood of negatively affecting other species nearby. The main drawback of this method is that the dead Rhododendron may persist in situ for 10-15 years. Dead plants can be left to deteriorate on site as they have no risk of recolonising. Progress should be seen on treated plants within 9 and 31 months.

Stump regrowth and seedlings may occur following treatment and will need to be re-treated once the regenerated plant reached 1m in height.

Below Table 3-1, outline the treatment application timetable depending on the chosen chemical and its dilution required.

Table 3-1 Herbicide Quantities to be Applied to Old Cut Stumps

Herbicide	Hazard classification for products	Selectivity	Product rate	Optimal time of year
Glyphosate (360g l-1) e.g. Roundup ProBiactive	Roundup ProBiactive and Envision – none	Non-selective	20% solution in water	October to February

3.3.3.3 Option 3 Foliar Application

This method entails foliar spraying, generally applied while the plant is in its first year of growth and before it exceeds 1.3m. Stump regrowth and seedlings may occur following stump treatment and can be effectively killed by spraying regrowth with a suitable herbicide, usually glyphosate when the growth reaches about 1m in height. Application using a knapsack sprayer at low pressure and a medium to high volume (500-750 1 ha -1) using a flood jet or solid cone nozzle is recommended. Rhododendron leaves are thick and waxy. For herbicide treatment to be effective each individual leaf needs be thoroughly wetted with herbicide to kill the plant. Herbicide application should take place in mild, frost-free, wind-free and rain-free conditions to avoid diffuse contamination.

Fresh herbicide should be used each day until all stems are treated in the survey area. Stems of branches that are still attached to the stumps will need to be targeted with a foliar spray, while stumps should be cut as low as possible to increase the likelihood of overall damage. Suboptimum treatment times but can be effective. In the case of glyphosate based herbicides consider higher concentrations 25-100% during May-October.

Table 3-2 outlines the recommended quantity of herbicide application to smaller/younger shrubs. Table 3-3 outlines the recommended quantity of herbicide application to mature shrubs.

Table 3-2 Herbicide Quantities to be Applied to Small Shrubs

Herbicide	Product rate	Optimal time of year
Glyphosate (360g l-1) e.g. Roundup ProBiactive	2.5% solution in water	March-October

Table 3-3 Herbicide Quantities to be Applied to Mature Bushes

Herbicide	Product rate	Optimal time of year
Glyphosate (360gl-1) e.g. Roundup ProBiactive	25% solution in water	March, April and October

3.3.4 Excavation and Waste Disposal

The top 0.5m of any soil that is excavated in the works area must be assumed to contain Rhododendron seed and therefore be either buried down to a depth of >0.5m to ensure no seeds are spread from the loosened clay or, be removed off-site to an appropriate waste facility.

All waste material leaving the site must be disposed of under an Article 49 (S.I. 477/2011) Transport Licence from the National Parks and Wildlife Service. All contaminated soils and/or material must be removed off-site to an appropriate waste facility under an Article 49 (S.I. 477/2011) Transport Licence from the National Parks and Wildlife Service by a licenced waste haulier and brought to a licenced waste facility.

Disposal options consist of either decomposing the accumulated whereby material is windrowed or mounded and let break down naturally on site or else burning the material.

4 BACKGROUND TO THE MANAGEMENT OF JAPANESE KNOTWEED

4.1 DESCRIPTION

The following brief description is included in order to assist those who may be operating on site, to better understand the nature of Japanese Knotweed; the extent of the problems it causes; and the importance of the fastidious management of contaminated sites.

Japanese knotweed is a perennial plant that was introduced to Ireland in the 19th century as a garden shrub. In recent years, this species has spread extensively throughout Ireland. Japanese knotweed is commonly carried by watercourses and along road networks, fly-tipping of hedge-cuttings on roadsides is one of the main methods by which knotweed spreads. A small fragment (the size of a fingernail) is enough to cause the growth of a full new plant[7], resulting in its successful colonisation of our habitats, where it outcompetes native vegetation.

The weed is a robust, herbaceous perennial with deeply penetrating woody rhizomes and bamboo-like stems, that can grow to 3m tall and can survive in all soil types. Propagation occurs via fragmentation (of stems and rhizomes) and underground rhizome growth, which can extend outward from the parent plant by 7m horizontally and to up to 3m in depth. These powerful rhizomes are capable of penetrating loose aggregates and growing through existing small cracks, openings or voids in asphalt/concrete. As a result, Japanese knotweed is extremely difficult to control.

As knotweed is naturally found on volcanic sites and fumaroles (openings in or near a volcano), its rhizome network is known to be heat resilient, therefore, burning does not destroy the plant. Cutting or any disturbance of knotweed plant material must be avoided unless a clear management plan is in place for dealing with the cuttings. Any piece of any part of the plant material must be treated as a biohazard on site. Furthermore, due to the high risk of spread via rhizome fragments, soil which may contain rhizomes cannot be moved off site, as to do so would be in contravention of Regulation 49 of the Birds and Natural Habitats Regulations. Therefore, it is considered that a potential suitable alternative is for the Japanese knotweed infestation (located towards the north-east of the proposed development site) to be buried at the bottom of a borrow pit (also located to the north-east of the site), within a root-barrier membrane.

Other negative impacts of this invasive species include:

- Loss of biodiversity;
- Increased flooding risk by impeding river-water flow;
- Increased riverbank erosion;

[7] Japanese knotweed removal / How to remove japanese knotweed / Clearway

- Economic loss, primarily associated with control costs in the construction sector;
- Delays to development;
- Aesthetic damage to gardens and landscaping; and
- Loss of amenity and recreational space.

4.2 IDENTIFICATION

Accurate identification of Japanese Knotweed, both the aerial and underground parts, is extremely important. The following information is provided as a guide. However, it is recommended that a suitably qualified person be engaged where confirmation of presence or absence of an invasive species is required.

4.2.1 Distinctive Characteristics

- It is rhizomatous (produces underground stems) with distinctive hollow, bamboo-like stems that can grow up to 3m in height.
- The mature canes are hollow and have a characteristic pattern of purple speckles.
- During the winter the leaves die back and reveal orange/brown woody stems.
- The underground rhizomes are thick, woody and when broken reveal a bright orange coloured centre.
- The rhizomes can extend laterally for up to 7m away from the parent plant. Small fragments of rhizomes can re-sprout, and the principal means of spread is through the deliberate or accidental movement of rhizome fragments or cut stems.

4.2.2 Aerial Parts

During the summer, Japanese knotweed has pointed, heart shaped leaves, approximately the size of a human hand which are staggered on the stem. In late summer/early autumn, small clusters of white/cream flowers will appear. The stems, which are hollow and bamboo-like, are green with red spots and have a distinctive zigzag appearance.

During late autumn and the beginning of winter, the knotweed canes die off and the weed becomes dormant. The leaves turn from green to yellow to brown and then fall off. The canes are hollow, dark brown and brittle.

4.2.3 Identification of Rhizomes

Japanese knotweed rhizomes are the underground part of the plant. A rhizome is a modified plant stem that sends out roots and shoots from its nodes. The outside of the Japanese knotweed rhizome is dark brown while the inside is bright orange/yellow in colour. As mentioned above, the rhizome system can spread up to 3m in depth and 7m laterally from the parent plant in certain circumstances, it may extend further this if the plant is particularly well established. The rhizomes are responsible for spreading the plant by vegetative means. As small fragments of rhizomes can re-sprout, the principal means of spread of this plant has been through the deliberate or accidental movement of rhizome fragments or cut stems.

4.3 CHOSING AN APPROPRIATE METHOD

There are seven options which are considered to be effective in the control and eradication of Japanese Knotweed. The method by which each of the seven options could be applied to the considered proposed development is described herein as part of this Management Plan.

The Japanese knotweed onsite covers less than 0.1% of the site. It is proposed this area should be fenced off from the remainder of the site (with a buffer zone of a minimum 7m) throughout the entirety of the construction phase. Once the Japanese knotweed infestation has been successfully treated, and the species has been eradicated from the location for a period of up to three years, the fencing can be removed.

4.3.1 Option 1- Herbicide Treatment

The control of Japanese knotweed will require the use of herbicides, which can pose a risk to human health, to non-target plants or to wildlife. In order to ensure the safety of herbicide applicators and of other public users of the site, it is essential that a competent and qualified person carries out the herbicide treatment. A qualified and experienced contractor will be employed to carry out all treatment work.

The contractor will follow the detailed recommendations of the following documents for the control of invasive species and noxious weeds:

- Chapter 7 and Appendix 3 of the TII Publication: The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads (NRA, 2010);
- Best Practice Management Guidelines for Japanese knotweed (Invasive Species Ireland, 2015); and
- Circular Letter NPWS 2/08 Use of Herbicide Spray on Vegetated Road Verges (National Parks and Wildlife Service 2008).

These documents include measures to aid the identification of relevant species, with details for the timing, chemicals and methodology for chemical control, and for measures to avoid environmental damage during the use of herbicides.

Chemical treatment involves the application of a herbicide to invasive species plant such as Japanese knotweed stands without any excavation or removal of the plant material. The preferred types of herbicides to be used in the treatment of Knotweed are Glyphosate and 2,4-D Amine.

If herbicide is applied as the treatment option, it may need to be reapplied for up to five years after the first application to ensure the plant control measures have been effective. Glyphosate is non-persistent and can be used near water but it is not selective (i.e. it is a broad spectrum chemical and will impact all plant species) whereas 2,4-D Amine can be persistent for up to one month, and can also be used near water but is more selective on certain plants. The selection of chemical by the contractor and supervising ecologist will depend on seasonal factors, site conditions, proximity to water, surrounding habitats etc.

The most effective time to apply Glyphosate 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.

Reapplication rates will depend on site specific considerations including the extent of the infestation, its location, and the time of year treatment commences. Details of the proposed chemical treatment plan will be included in the updated ISMP.

Foliar treatment (spraying) is usually applied with a sprayer such as a knapsack sprayer or a larger spray system. It is important to use a treatment dye to identify clearly all areas treated. Foliar treatment 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. In

the case of 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 will be required usually within ten days, before the internal vascular system is no longer capable of translocating the herbicide to the root system.

While the upper surface of the leaves will be easier to treat, it is also important to treat the leaf under surface as Knotweed possesses many stomata openings on the leaf under surface. Dead stems can be cut, removed and burned on/off site in accordance with the relevant legislation.

The stem injection method is sometimes used for Japanese knotweed control. 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 10 mL 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 by injection is most effective when applied in the early Autumn (mid to late Sept).

Regrowth will occur in subsequent years, albeit much less vigorously, which will require follow up treatment at the appropriate time of year. Spot treatment will be required each year until no regrowth is observed.

In order to ensure that the use of herbicides does not contravene legislation, the contractor must comply with Circular Letter NPWS 2/08 Use of Herbicide Spray on Vegetated Road Verges from the National Parks and Wildlife Service dealing with the application on to non-target areas.

This treatment of Japanese knotweed must run for a duration in excess of 3 years, during this time the area will be fenced off until the invasive species has been successfully treated and fully eradicated from the area. The following criteria need to be fulfilled for successful herbicide treatment of knotweed:

- It is essential that treatment is undertaken by a competent and qualified person and overseen by an Ecological Clerk of Works (ECoW).
- Successful treatment requires a long-term Knotweed Management Plan for herbicide treatment, this invasive management plan should be updated by a suitably qualified person.
- Glyphosate is recommended as non-persistent if treated material is to be buried. Other herbicides are more appropriate for spot treatment and stem injection. The choice of herbicide to use is site and situation-specific and must be written into the Method Statement once the contractor has been appointed, and the timescale of the work made clear.
- Contractors working on the site must be fully informed as to the treatment plan and the potential consequences of mishandling plant parts and contaminated soil.
- Chemical treatment helps to contain the spread of the plant. Once chemical treatment begins, the rhizomes will cease to spread, and underground damage will be limited.
- Chemical treatment is a long-term measure, and only suitable when the site is not predicted to be disturbed for more than 3 years. Even after all growth has stopped, rhizomes may remain viable and future disturbance could potentially reactivate growth.
- Failing to allow plants to reach a certain stage prior to herbicide treatment can increase the amount of time required for treatment, along with associated costs. It should be noted that water stress can reduce the herbicide uptake of the plants.

Herbicide treatment alone is not recommended on sites with future development plans that involve the soil being dug and disturbed.

4.3.2 Option 2- Combined Treatment

Combined treatment involves digging and a herbicide treatment in combination. This method is employed in situations where treatment of the Japanese knotweed is required to be completed in a shorter timeframe[8]. In summary, this management method requires cutting and killing of the surface plant. The cut material must be left on top of plastic sheeting until dried out and subsequently monitored for any sign of regrowth. Storage of cut material should not take place within flood risk zone of a river. The cut material should not be placed in a green waste recycling bin. Once dried out, the material should be burned on site in accordance with the relevant legislation. The surface of the affected area should be raked with tines to remove crowns and surface material, and in order to break up the rhizomes, bringing them to the surface, which will stimulate leaf production. This will make the plant more vulnerable to herbicide treatment. The more rhizomes that are brought to the surface, the more growth will occur, allowing for a more successful treatment. An excavator can be used to scrape the surface crowns and rhizomes into a pile and then to cultivate the ground to stimulate rhizomes to produce a higher density of stems for treatment. Reapplication of herbicide may be required for up to five years after initially application, subject to the site-specific management plan. Best practice guidelines state that the treatment of the site is carried out over a timeframe greater than 18 months (EPA, 2013). However, after consultation with specialist contractors it is recommended that a three-year treatment programme followed by two years of no growth is carried out. The area with Japanese knotweed should be treated accordingly using herbicide treatments. The following criteria need to be fulfilled for successful combined treatment of knotweed. This method can be undertaken effectively at any time of the year.

- Break up the rhizome and bring it to the surface by digging, this stimulates leafy growth and maximises the uptake of subsequent herbicide treatments to the rhizome.
- Repeat the treatment to continuously weaken growth and expose deeper rhizomes which could not otherwise be as effectively treated.
- Digging while the ground is wet should be avoided as it will compact the soil and slow down growth, reducing uptake of herbicide and compromising treatment.
- It requires the treatment of the entire contaminated area.
- Good site hygiene practices and decontamination of vehicles and equipment is essential.
- This method cannot guarantee complete destruction of the rhizomes.
- Crown removal can be integrated into these works, including prior to the commencement of herbicide treatment. Crown removal will involve transportation offsite and will be subject to licencing from NPWS.
- Rhizome dormancy can be induced by a poor herbicide treatment, however, ground disturbance will encourage regrowth, so this does not happen.

4.3.3 Option 3- Bund Method

Excavated material is transferred to a bund, where it is contained and chemically treated for at least 18 months. The following criteria need to be fulfilled for successful bunded treatment of knotweed:

- This method is suitable when deep burial is not an option.
- It requires adequate available area for construction of a suitable bund.

[8] Irish Water (IW-AMT-009). Irish Water Report. Information and Guidance on Japanese Knotweed Asset Strategy and Sustainability.

- The bund should ideally be 0.5m deep and not greater than 1m deep. Rhizomes buried any deeper than this are likely to go dormant and not respond to herbicide treatment.
- The underlying site must be protected by a root barrier membrane. A clear area around the bund must be provided to facilitate the monitoring and treatment of any accidental spread.
- The bund should not be built within 50m of a watercourse, or adjacent to trees.
- Chemical treatment of knotweed should be carried out prior to excavation to minimise the risk of the aerial parts of the plant being spread, and to weaken the rhizome, optimising successful treatment of contaminated soil.
- Fertiliser should be applied several weeks before herbicide is applied, if time allows, encouraging growth and maximising uptake of herbicide.
- The choice of herbicide should be specific to the site and Management Plan.
- The bunded area should be chemically treated for an adequate time to effectively eradicate all rhizome and crown material.
- Full eradication must be confirmed by a suitably qualified person before treatment measures are abandoned. The length of treatment period is likely to be <2years, as the rhizome will have been weakened by chemical treatment of the vegetation.

4.3.4 Option 4- Deep Burial Method

Excavated material containing Knotweed can also be buried on site. This method requires the "deep burial" of contaminated soil on-site to a depth whereby there is a minimum of 5m of uncontaminated overburden above the contaminated material. Assuming good site hygiene practices are followed, this option minimises the possibility of material escaping by accidental wind-blow or wash-off.

- Dig a trench or pit, adequate to contain all excavated material at a depth greater than 5m.
- All machinery should be decontaminated on site after contaminated material has placed in the trench, before a root barrier membrane is placed over it and the backfilling takes place with uncontaminated soil or inert material to a depth of 5m. The manufacturer's guarantee is required that the membrane will stay intact for at least 50 years.
- Accurately map and record the location of the burial site to prevent any future accidental disturbance. Inform future owners of its position.
- If soil containing Japanese knotweed is stockpiled, the material must be stored in a manner that will not harm health or the environment.
- The stockpile should be on an area of the site that will remain undisturbed. The area should be clearly fenced and marked with warning signs, and the stockpile should be regularly treated with herbicide to prevent any regrowth or re-infestation.
- Off-site transport of material does not take place, and therefore material is not spread outside of the contaminated area.
- Pre-treat the area with herbicide before burial to speed up die-off. Persistent herbicides must not be used prior to burial.
- As a precaution, the stockpiled material should be laid on a root barrier membrane and covered to avoid contaminating the site further.
- The contractor must also comply with all waste legislation.
- After 50 years, the material should have died off completely, but the site and its contents must be clearly communicated to future land-users to avoid accidental disturbance.
- If the ground is disturbed before complete die-off is achieved, the dormant rhizome could be reactivated.

4.3.5 Option 5- Root Barrier Membrane Method

This method requires the excavation of a "root-barrier membrane cell" which will contain the contaminated material and is buried beneath a minimum of 2m overburden. The procedure is similar to that described in Section 4.3.4 above.

Please note that the excavated contaminated material and the wash down from any machines and tools which have come into contact with the excavated material will also be contained in this root barrier cell ensuring that all material is wrapped in a suitable membrane and buried beneath a minimum of 2m deep of overburden within the development site. The membrane used to wrap the contaminated soil shall have 50 years guaranteed design life and be suitable for the containment of Japanese Knotweed. The method for stockpiling prior to burial would be as described as above. The contractor must also comply with all waste legislation.

The following criteria need to be fulfilled for successful root membrane treatment of knotweed on this site:

- Where there is a risk of knotweed encroaching from neighbouring sites, a root barrier membrane shall be used to protect the site from further encroachment.
- The root barrier membrane shall contain all rhizomes and it should be a requirement of the contract that it is specified, designed, supplied, supervised and certified at completion by a suitably qualified person.
- The minimum design life of the root membrane shall be 50 years. A manufacturer's guarantee is to be supplied by the contractor.
- The root membrane shall be used for creating the cell(s) for burial, for preventing spread from the encapsulated area and original excavated area, and for protecting services and infrastructure in these areas.

It is noted that the membrane treatment will be present on-site after all vegetation is dead, and the contractor will be required to document all activities in this regard so that any potential legacy issues can be managed in the future.

4.3.6 Option 6- Off-Site Disposal

Where the above treatment options are not possible because the site is too small to contain excavated material, or too shallow for burial, or where there is a lack of space or where the infestation simply cannot be avoided by the construction works, removal of excavated material may be the only option. Off-site disposal of material is only to be considered as a last resort when none of the other treatment options can be carried out.

If any invasive species plant material is collected (e.g. by hand-pulling or mowing), it is important that its disposal will not lead to a risk of further spread. Where there are small amounts of knotweed material to be removed it is possible to double bag the material and send to a licenced waste facility for disposal. Where the amount of material is larger in volume, it will be necessary to haul it from site to a suitably licenced waste facility.

- Invasive species material, particularly roots, flower heads or seeds, must be disposed of at licensed waste facilities appropriately buried, or incinerated in compliance with the relevant legislation.
- Disposal must be carried out in accordance with the relevant waste management legislation. Invasive species plant material or soil containing residual herbicides may be classified as either 'hazardous waste' or 'non-hazardous waste' under the terms of the

Waste Management Acts, and both categories may require special disposal procedures or permissions.

- If the material has been treated with a persistent herbicide, the excavated material must be classified as hazardous waste and must be disposed of to a hazardous waste facility.
- Advice would need to be sought from a suitably qualified waste expert regarding the classification of the waste and the suitability of different disposal measures.
- Any movement of material into areas where infestation has not already occurred carries the risk of introducing Japanese knotweed to the area, in contravention of Regulation 49 of the Birds and Natural Habitats Regulations.
- Contaminated soil and plant material can only be transported under licence from the National Parks and Wildlife Service (NPWS) under Section 49 of the European Communities (Birds and Natural Habitats) Regulations, 2011 (as amended).
- Material must only be brought to a licenced landfill which has acknowledged the nature of the infestation and has agreed in writing, in advance, to accept and treat the material appropriately.
- The Management Plan must outline all biosecurity and treatment measures to be taken to prevent escape of contaminated material.
- Monitoring of the area will still be required, and any regrowth should be treated by herbicide.

4.3.7 Option 7- Soil Screening

This method requires all viable parts of Japanese knotweed to be extracted and removed off-site to a licenced facility or destroyed by incineration. Soil screenings and sieving methods can provide effective means on rhizome removal. If soils have been efficiently screened it can be re-used onsite, however, it should not be re-used off-site unless being disposed of at a licenced waste facility. This method can be undertaken effectively at any time of the year. This method should be combined with the herbicide treatment if re-growth is recorded after screening. Contaminated soil must show two years no growth before it can be disturbed by the development. It is recommended that this treatment option is carried out over a three-year treatment programme followed by two years of no growth is carried out.

- This method is viable in areas with large amounts of infected soils and materials.
- Material that is removed off-site, must only be brought to a licenced landfill which has acknowledged the nature of the infestation and has agreed in writing, in advance, to accept and treat the material appropriately.
- The Management Plan must outline all biosecurity and treatment measures to be taken to prevent escape of contaminated material.
- Monitoring of the area will still be required, and any regrowth should be treated by herbicide.
- This treatment option can be carried out with the combined treatment.

Re-surveying/monitoring provides information on the success of the management methods and allows for the planning of follow-up treatments. Sites with a strong likelihood of reinvasion should be surveyed every year and treated appropriately.

5 INVASIVE SPECIES MANAGEMENT STRATEGY

5.1 MANAGEMENT OBJECTIVES

The purpose of this document is to provide the client (Cloghercor Windfarm Ltd. and appointed contractor with a sufficiently detailed account of the control and management measures required to eradicate and prevent the further spread of invasive species during the course of the proposed works. Details of the necessary steps that must be taken to ensure the proposed works do not lead to the spread of Invasive Alien Species are discussed in Section 5.2 below. The requirements to avoid the spread of Rhododendron and Japanese knotweed will be discussed in turn.

The objectives of this Invasive Species Management Plan are to:

- Identify the extent of the infestation on the site;
- Ensure further growth and spread of the plants on the site does not occur;
- Ensure the plants are not spread to other sites, either adjacent to the infested site or through transportation of contaminated soil to another site;
- Identify the best method for eradicating, managing and controlling Rhododendron and Japanese knotweed on the site with regard to the proposed site works and construction methods;
- Communicate the plan to all site operatives to ensure success of the plan; and
- Document and record the treatment and management methods carried out on site for future reference, for future site owners and site users and to avoid litigation.

The contractor must employ a suitably qualified ecologist to update the plan prior to the commencement of construction. Should any risk of contaminated material escaping be observed, the management plan for the site must be modified by an appropriately qualified person to mitigate against that risk. The updated plan must contain the following:

- Site background including proposed works;
- Extent of the Japanese knotweed and Rhododendron infestation;
- Specific control plan to be put in place;
- Site hygiene protocols;
- Responsible individuals;
- Follow up requirements; and
- Any other relevant information.

Prior to both ISMP works and construction works commencing onsite, a Risk Assessment Method Statement (RAMS) must be produced by the appointed contractor. The following guidelines, while comprehensive, are not exhaustive, and shall be followed by all personnel on site.

5.2 MITIGATION MEASURES FOR THE TREATMENT OF INVASIVE SPECIES

During construction works, the spread or introduction of alien invasive species and noxious weeds will be avoided by adopting appropriate biosecurity measures, as per guidance issued by the Transport Infrastructure Ireland (TII) (2010), Invasive Species Ireland (2008), Good Practice Management for Japanese Knotweed (RAPID, 2018) and Inland Fisheries Ireland (IFI)[9] with

[9] https://www.fisheriesireland.ie/Biosecurity/biosecurity.html

respect to the protocols developed for the control of the spread of alien invasive species to both the aquatic and terrestrial environment, including the following measures:

The presence of alien invasive species and requirement for actions (if any new invasive species are found to be present onsite) will be confirmed by a suitably invasive species specialist or qualified ecologist.

Depending on the timescale for the construction of the proposed scheme, it may be possible to eradicate some species prior to the onset of construction on the site via an advance treatment contract. This would be preferable.

In addition to the possible advance treatment works and pre-construction survey, areas identified as requiring specific invasive species treatment will be demarcated and the designated control measures implemented at the earliest possible stage to reduce the risk of spread along the proposed scheme or beyond the land take.

There is a number of management options that may be implemented to control and prevent the spread of invasive species (Section 6 & 7) Those involved in the application of herbicides/pesticides will be competent to do so and, consequently, will have sufficient training, experience and knowledge in the area of herbicides/pesticides application.

All staff involved in the application of herbicides/pesticides will have received appropriate training, which may include achieving competency certification in the safe use of herbicides/pesticides through a National Proficiency Tests Council registered assessment centre or achieving an appropriate FETAC award in this area.

However if control programmes have not been achieved before construction begins, then site hygiene measures listed below in Section 5.2.1 will need to be put in place to ensure that the further spread of invasive species is avoided. As mentioned previously, it may be necessary to implement an advance works contract to commence treatment of Invasive species before construction starts. By treating in advance there will be much more control over the spread of infestations. Infestations if left untreated, may spread further by the time construction commences. The specific treatment method needs to be established.

5.2.1 Establish Working Area/Bio-secure Zone

- Fencing will be established around each working area hosting the invasive species. In this case, the bio-secure zone will be 7m away from the visible plant parts of Japanese knotweed. This will ensure all areas scheduled to be treated are included in the area fenced off. This will inform personnel that access into and out of the area is restricted. Signage should be erected along the fencing to avoid unnecessary contact with the plant or surrounding contaminated soils.
- A RAMS must be provided by the contractor prior to commencement of any works.
- A designated wash-down area is to be created, where material from a power-washed vehicle can be effectively contained, collected and buried/removed off-site along with other contaminated material. The area must have a washable membrane or hard surface.
- Stockpile areas shall be chosen to minimise movement of contaminated soil.
- Any stockpiles must be marked and isolated.
- Using tracked machines within the contaminated area is likely to contribute to the spread of seeds and should be avoided.
- The onsite clerk of works will monitor and oversee implementation for the plan.
- In the event of there being difficulty in sealing the area adequately, the contractor shall not move any contaminated soil from the excavation site, but shall refer back to the

ECoW or Ecologist, who will consult with an appropriately qualified person to design alternative measures.

5.2.2 Decontamination of Vehicles and Equipment

Any vehicles travelling off-road to excavate, and any vehicles and equipment used to treat invasive species within the proposed development must adhere to the following recommendations:

- Decontaminating may only take place within a designated wash-down area;
- Prior to arrival on site and on departure, the contractor's vehicles and equipment must be thoroughly cleaned. High-pressure steam cleaning, with water > 60°C, is recommended for vehicles and equipment where reasonably feasible. If it is not possible to steam clean the equipment, a normal power hose must be used. After cleaning, equipment will be visually inspected to ensure that all adherent material and debris has been removed;
- Vehicles and machinery must be cleaned using stiff-haired brush and pressure washer, paying special attention to any areas that might retain seeds such as wheel tyre threads and wheel arches;
- All vehicles and machinery should be cleaned before and after using them to excavate invasive species contaminated material;
- All equipment (including footwear) that has come into contact with water or soils will be visually inspected for evidence of attached plant or animal material, or adherent mud or debris. This should be done before entering and leaving the site. Any attached or adherent material will be removed before entering or leaving the site;
- Run-off from wash-down area must be isolated and treated as contaminated material;
- All contractors will be required to sign a prepared form detailing the nature of the cleaning process carried out and the date on which this was conducted; and
- No vehicles should watercourses during the construction or operation of the proposed development.

5.2.3 Transporting Contaminated Material

This step should only be carried out if all other options are not viable:

- Stockpile areas shall be chosen to minimise the movement of contaminated soil. Any stockpiles must be clearly marked and isolated;
- A licence from the NPWS must be obtained for the transportation of contaminated material;
- Additional to this, if the material has been treated through chemical means it may need to be classified as hazardous waste;
- Vehicles used to transport materials must be lined and covered and shall be decontaminated before they leave the work zone;
- Do not fill the truck to the very top (min 20cm) and seal securely with a suitable membrane for transportation to ensure no material can escape; and
- Biosecurity measures as outlined above shall be implemented for de-contamination.

5.2.4 Preventing Further Spread and Introduction of Invasive Species

The priority of these works is to contain the Rhododendron and Japanese infestation and prevent further spread to areas which are not currently contaminated:

- The surrounding area will be isolated by closing the works area to all pedestrian and vehicular traffic during excavation and construction, until such time as the site has been reinstated;
- Biosecurity measures shall be put in place to avoid the accidental transport of material;
- Biosecurity measures will consist of fencing off the area of the Japanese knotweed infestation and providing a wash-down and de-contamination area for any vehicles and equipment used to treat the invasive species on site;
- On completion of works and decontamination of the site, biosecurity measures shall be removed under the supervision of the ECoW;
- No material will be removed off-site without prior consultation and consent from the ECoW. This Management Plan does not include for the transport and disposal of materials off-site; and
- All materials entering site must be checked to ensure their sources are free of invasive species, particularly soil and plant material.

5.3 PRE-CONSTRUCTION SURVEY

Since invasive species spread quickly, prior to the commencement of treatment, a pre-construction survey will be undertaken to identify the extent of invasive species at that time. The survey will be undertaken by a suitably qualified ecologist. This information will be utilised to update the ISMP.

6 RHODODENDRON MANAGEMENT STRATEGY TREATMENT FOR THE PROPOSED DEVELOPMENT

A detailed account of the various treatment options for Rhododendron are outlined in Sections 3.3.1 to 3.3.4.

6.1 ASESSMENT OF TREATMENT OPTIONS

Table 6-1, Table 6-2 and Table 6-3 assess the mechanical and chemical treatment options for Rhododendron alongside the advantages and disadvantages of each, noting any suitable/unsuitable site conditions. Each method has been allocated a score to indicate most to least preferable, with 1 being the most preferred.

Table 6-1 Summary and Assessment of Mechanical Treatments

Mechanical Treatments	Advantages	Disadvantages	Site Conditions	Rating
Option 1- Cutting	N/A	• Generally found to be ineffective on its own • Only suitable for smaller infestations • Labour intensive • Expensive	Rhododendron infestation is spread widely across the site	2
Option 2-Chainsaw Cutting of Root-ball	• Suitable for soft-soil areas • Can be used in combination with winching methods to reduce ground disturbance	• Requires skilled operators • Can cause significant wear and tear on equipment	Proposed development is located in a bog area, therefore soil would be softer and suitable for this option	3
Option 3- Uprooting by Hand	• Found to be an effective method • Suitable for younger plants • More cost effective in the long run	• Not possible to use on larger plants	Majority of plants on site were recorded as being saplings, this method would therefore be suitable for the bulk of the infestation	1
Option 4- Uprooting by Tractor	• Found to be an effective method • Suitable for larger plants	• More labour intensive • Can cause significant soil disturbance • Requires anchor points and tractor access points to the site	Soil disturbance may be an issue due to the soft soil within the proposed development site.	4
Follow up Treatment 1- Mulching	• Reduces soil disturbance	• Costly • Relatively new method	Not suitable due to infestation being spread out across the proposed development area, land will need to be used for construction phase, it would also be too costly to cover a large area with heavy duty geo-textile	6
Follow-up Treatment 2- Bud-Rubbing	• No need for chemical input for this option	• Relatively new method, under researched, effectivity is unknown • This option is labour intensive	This option could be unsuitable due to labour intensity resulting from the large infestation within the proposed development site	5

Table 6-2 Summary and Assessment of Chemical Treatments

Follow-up Treatment	Advantages	Disadvantages	Site Conditions	Rating
Option 1- Cut Stump	• Targeted treatment, reduces likelihood of harm to surrounding species • This option is an effective treatment	• This option is labour intensive • It is also seasonally restricted • It is time sensitive as plant needs to be treated as soon as possible after cutting	Suitable for small number of larger shrubs growing on site	3
Option 2- Stem Injection	• Even more targeted than option 1, reduces likelihood of harm to surrounding species • This option is an effective treatment • Dead plants can be left to deteriorate on site as they pose no risk of recolonising	• Dead Rhododendron may persist in situ for 10-15 years • Is seasonally restricted • This option is labour intensive • It is time sensitive as plant needs to be treated as soon as possible after drilling	Suitable for small number of larger shrubs growing on site	1
Option 3- Foliar Application	• Suitable for smaller, younger plants	• This option is seasonally restricted	Suitable for younger plants and saplings growing on site	2

Table 6-3 Summary and Assessment of Disposal Options

Stage 2 Options	Advantages	Disadvantages	Site Conditions	Rating
Decomposition	• Material naturally broken down	• May be a slower process	Is likely the most suitable option for the site	1
Burning	• Effective	• May cause more environmental harm if carried out over a large area	Area of infestation too large, furthermore, Heather (*Calluna vulgaris)* was found to surround the rhododendron, this vegetation is highly flammable.	2

6.2 RECOMMENDATIONS FOR THE TREATMENT OF RHODODENDRON

After careful consideration of the advantages and disadvantages of each treatment method along with site conditions, it is recommended that a combination of Mechanical Option 3- Uprooting by Hand and Chemical Treatment, Option 3- Foliar Application (to be used on young plants/saplings) and Option 2- Stem Injection to be used on older established plants.

Due to the large area of infestation and surrounding heather, it is recommended that waste material be decomposed on site.

It should take around 3-4 years of annual treatments to clear the worst of the infestation after which, annual checks will need to occur to detect any new seedling growth. A monitoring and treatment plan will then be necessary should any re-growth of Rhododendron detected. Seed banks of this species may remain within the soil, so monitoring and an additional treatment plan will be crucial in eradicating the Rhododendron from the proposed development site.

7 JAPANESE KNOTWEED STRATEGY TREATMENT FOR THE PROPOSED DEVELOPMENT

Below in Table 7-1 is an assessment of Japanese Knotweed treatment options. The assessment aims to summarise the advantages and disadvantages of each treatment along with mentioning any determining suitable/unsuitable site conditions. Each method has also been allocated a score to indicate most to least preferred, with 1 being the most preferred.

Table 7-1 Summary of Japanese Knotweed Treatments and Ratings

Treatment Option	Advantages	Disadvantages	Site Conditions	Rating
Option 1 – Herbicide Treatment	• Cost effective • Less risk of spreading offsite • Easy to administer • Treatment can be carried out in situ without risk of spreading	• Can take many years and may not eradicate rhizomes completely • Two years of monitoring required after treatment • Some herbicides are persistent in soil and risk being disturbed if construction works are planned • Regrowth can occur if soil is disturbed • Can induce dormancy	The river Mulnamin_Beg_010 is situated 50m and 61m from the two large infestations of Japanese knotweed within the proposed development. This option could be viable if the river is outside of the buffer zone Buffer Zones for pesticide use are generally identified on the product label and are typically 5-10m, but can also extend to 70m.	5
Option 2 – Combined Treatment	• Increases effectiveness of herbicide treatment • Less chance of rhizome dormancy • Breaks up and aerates the soil • Crown removal removes large amounts of surface and underground biomass • Cost effective	• Crown removal can be time consuming • If mechanical disturbance is not done correctly, it can cause rhizome dormancy • Crowns and dead stalks will still need to be disposed of offsite • Some herbicides are persistent in soil	The river Mulnamin_Beg_010 is situated 50m and 61m from the two large infestations of Japanese knotweed within the proposed development. This option could be viable if the river is outside of the buffer zone Buffer Zones for pesticide use are generally identified on the product label and are typically 5-10m, but can also extend to 70m. However, the infestation is also in close proximity to the road where upgrade works will be occurring, this would therefore increase the risk of spreading Japanese knotweed.	4
Option 3 – Bund Method	• Treatment may be less than 2 years • Treatment can be carried out in situ without the risk of spreading	• Will require a designated area onsite for treatment where it will not be disturbed • Requires excavation the infested area and moving to a fully secure area, increasing the risk of spreading • Must be bunded in an area not more than 1m deep	Borrow pits will be available for this method on-site.	3

Treatment Option	Advantages	Disadvantages	Site Conditions	Rating
		• This option would also increase the risk of further infestation throughout the site.		
Option 4 – Deep Burial Method	• Allows controlled destruction of the plant and its root material • Works can continue immediately after burial • Quickly removes Japanese Knotweed from an undesirable area	• Cannot be buried while herbicides are active • Risk of future reactivation if not marked clearly • Must be kept separate from any other rubble or waste • Only good where soil is not already contaminated • The use of the area above burial site is limited • Requires a large hole to take material, if the soil is shallow or the water table this method may not be feasible • Requires excavation the infested area and moving to a fully secure area, increasing the risk of spreading	Borrow pits will be available for this method on-site.	1
Option 5 – Root Barrier Membrane Method	• Prevents the horizontal spread of rhizomes • Works can continue immediately after installation	• Can tear easily if not installed correctly or if the ground or excavated material contains rock or rubble • Tears in sheets can be exploited by growing rhizomes • Can only be installed in favourable weather conditions • Surface water drainage and water table can affect installation and ponding can occur	Borrow pits will be available for this method on site.	2
Option 6 – Off-site Disposal	• Time effective – quickly removed Japanese Knotweed from site	• Relatively expensive • If area is contaminated with other materials soil screening may be required to take place	No site constraints exist for this option, however, transporting infested soil of-site should generally be utilised as a last resort .	7

Treatment Option	Advantages	Disadvantages	Site Conditions	Rating
	• No restrictions will be left onsite • Work can continue immediately after removal • Fast and efficient	• Will require a licence for transfer • Must be disposed to a licenced facility • Increases risk of spreading by moving materials offsite • Should be considered a last resort, when no other treatment is suitable		
Option 7 – Soil Screening	• Segregates the infected materials from inert materials • Increases effectiveness of herbicide treatment • Lesser chance of re-growth • Cane, crown removal and rhizome removes large amounts of surface and underground biomass • Less chance of rhizome dormancy if the majority of rhizomes are removed • Cost effective • Infested area can be treated in situ without needing additional space for treatment	• Crown removal and screening/sieving can be time consuming • Canes, crowns and rhizomes will still need to be disposed of offsite under licence or incinerated • Some herbicides are persistent in soil	No site constraints exist for this option, however, transporting infested soil of-site should generally be utilised as a last resort.	6

7.1 RECOMMENDATIONS FOR THE TREATMENT OF JAPANESE KNOTWEED

After careful consideration of the advantages and disadvantages of each treatment, site conditions and extent of the Japanese knotweed infestation, Options 2-Combined Treatment, Option 4-Deep Burial Method, Option 5-Root Barrier Membrane Method and Option 3-Bund Method were all found to be viable options for treatment.

It should take around 3-4 years of annual treatments to clear the worst of the infestation after which, annual checks will need to occur to detect any new seedling growth. A monitoring and treatment plan will then be necessary should any regrowth of Japanese knotweed detected. Seed banks of this species may remain within the soil, so monitoring and an additional treatment plan will be crucial in eradicating this Japanese knotweed from the proposed development site.

8 CONCLUSION

Recommended treatment options for Rhododendron and Japanese knotweed have been specified in Section 6.2 and Section 7.1.

Rhododendron and Japanese knotweed are high-risk invasive species plants and will need to be treated in accordance with this ISMP.

Treatments will need to be carried out in the recommended timeline under supervision of a qualified ecologist.

This information will be utilised to determine the extent of the extent of the contaminated area and will be then used to update this ISMP. Detailed fencing and hygiene protocols will ensure the viable plant material will not be spread outside of its current distribution area Following completion of works, monitoring and treatment protocols will be implemented to ensure any regrowth is effectively treated.

This plan deals exclusively with the current site boundary of the proposed development, including the Turbine Delivery Route (TDR). In the unlikely event that invasive species are detected along the TDR, this plan will be update to include details of new invasive species locations and recommended treatments. Consultation with the NPWS must also be sought to ensure this plan is adequate for the proposed works.

The ECoW shall monitor establishment of a bio-secure zone and clean-down area set up by the contractor. The steps described in Section 5.2 must be adhered to by the contractor.

9 REFERENCES

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