VikingCCS

Viking CCS Pipeline

9.32 Outline Invasive Non-Native Species Biosecurity Management Plan

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1 Summary

1.1.1 Invasive non-native species (INNS) have been identified, as part of ecological assessments, within the DCO Site Boundary, specifically:

- Himalayan balsam (*Impatiens glandulifera*);
- Canadian waterweed (*Elodea canadensis*); and
- Signal crayfish (*Pacifastacus leniusculus*).

1.1.2 Due to their negative impacts, various legislation has been enacted with the aim of reducing introductions and spread of INNS. Industry good practice states that, where INNS are identified within the footprint of a development, an evidence-based options appraisal should be carried out to identify optimal mitigation. This document presents such an appraisal and provides an overview of the protocols required to prevent spread and introductions during the development of the Viking CCS Pipeline.

1.1.3 This Outline Biosecurity Management Plan (BMP) provides information on how identified INNS should be managed under different scenarios, and has four main objectives. These are to:

- identify, and respond to, additional INNS risk (beyond that currently known);
- demine feasible mitigation for identified INNS and specify how it should be applied;
- minimise INNS related environmental, waste, carbon, and cost impacts; and
- ensure compliance with legislation and industry good practice.

1.1.4 A location specific Action Plan, or Method Statement, should also be produced, prior to development works commencing in each area, for each occurrence of terrestrial INNS identified within the DCO Site Boundary. This Action Plan should be location and task specific, should specify the precise actions to be taken in a given location (in line with this Outline BMP), and should include an accurate distribution map, with species appropriate buffer zones, for the INNS.

1.1.5 Additionally, the protocols specified within this BMP, for working in aquatic habitats, should be integrated into the Method Statements for all works that interact with aquatic habitats.

1.1.6 Based on an assessment of all control options, the optimal approach to managing the INNS identified within the DCO Site Boundary will involve a combination of:

- pre-development surveys and responses (i.e. Action Plan production);
- avoidance measures and biosecurity implementation;
- herbicide treatment / hand pulling / strimming;
- excavation, temporary stockpiling, and re-use of arisings (potentially); and
- monitoring and remedial response.

1.1.7 The next steps are to:

- carry out INNS specific surveys (i) in the location of terrestrial INNS identified during other ecological assessment, (ii) for the location of other INNS records returned by desk study within the DCO Site Boundary, and (iii) where the presence of key introduction pathways makes the presence of INNS more likely (i.e. adjacent to waterways and within floodplains);
- produce Action Plans, as required, following the above surveys;

- commence control action, as far in advance of the onset of development works, where doing so will support achieving the goals of minimising INNS related environmental, waste, carbon, and cost impacts.

1.1.8 This Outline BMP will be updated as required (i.e. if and when additional INNS are identified).

2 Introduction

2.1 Context

2.1.1 An invasive species management plan, for the Viking CCS Pipeline, is required to be developed under mitigation measure B1.

2.1.2 Species that have been introduced to a territory outside of their natural ecological range are known as non-native or alien species. A minority of these species survive, spread, and become detrimental to the environment. These detrimental species, with measurable negative environmental and / or economic impacts, are referred to as Invasive Non-Native Species (INNS).

2.1.3 INNS primarily impact on native biodiversity, both at the level of individual affected species and often in terms of broader ecosystem structure and function. and can also have negative impacts on human health and cause economic damage (Lodge *et al*., 2009; Gallardo *et al*. 2016).

2.1.4 Large scale linear infrastructure projects, in particular, can present a significant risk with respect to INNS. This is because construction crosses multiple habitat types over a long distance, which means there is a risk that an INNS present in one location could be spread along the route, distributing the species across multiple habitats and to new locations.

2.1.5 Due to their impact, various legislation has been enacted with the aim of reducing the introduction and spread of INNS. Section 2.3 of this report provides a summary of relevant legislation and other key drivers. Industry good practice dictates that, where INNS are identified within the footprint of a development, an evidence-based options appraisal be carried out to identify optimal mitigation. This document presents such an appraisal and provides an overview of the protocols required to prevent spread and introductions during the development of the Viking CCS Pipeline.

2.2 Viking CCS Pipeline - Project Overview

2.2.1 The Viking CCS Pipeline (‘the Proposed Development') comprises a new 24 inch (609 mm) diameter onshore pipeline of approximately 55.5 km in length, which will transport Carbon Dioxide (CO2) from the Immingham industrial area to the Theddlethorpe area on the Lincolnshire coast, where it will connect into the existing 36 inch (921 mm) diameter offshore LOGGS pipeline.

2.2.2 For the majority of the route it will be buried to a minimum depth of 1.2 m from the top of the pipe to ground level. This will be deeper at crossing points such as railways, roads and watercourses.

2.2.3 The Proposed Development is an integral part of the overall Viking CCS Project, the intention of which is to transport compressed and conditioned CO2 received at a facility at Immingham to store in depleted gas reservoirs deep under the Southern North Sea. The offshore elements of the Viking CCS Project, including the transport of CO2 through the LOGGS pipeline to the Viking gas fields under the North Sea, are subject to a separate consenting process.

2.2.4 The key components of the Proposed Development comprise:

- Immingham Facility;
- approximately 55.5 km 24 inch (”) onshore steel pipeline (including cathodic protection);
- three block valve stations;
- Theddlethorpe Facility;

- existing LOGGS pipeline and isolation valve to the extent of the Order Limits at Mean Low Water Springs (MLWS);
- permanent access to facilities;
- mitigation and landscaping works;
- temporary construction compounds, laydown, parking and welfare facilities;
- temporary access points during construction.

2.2.5 Further details of each element of the Proposed Development are set out in Environmental Statement Volume II Chapter 3 Description of the Proposed Development (Application Document 6.2.3).

2.3 Legislation

Legislation

2.3.1 The GB Invasive Non-native Species Strategy (Defra 2015) and the Invasive Alien Species (Enforcement and Permitting) Order 2019, direct landowners and managers to adopt a proactive biosecurity driven approach to INNS management. The Environment Agency, Natural England and the Forestry Commission advocate this proactive approach.

2.3.2 This approach is underpinned by several legislative instruments within England which relate to INNS (Table 2.1). The purpose of this legislation is to prevent and reduce the negative economic and environmental impacts of these species. INNS of particular concern are referenced in relevant legislation, specifically:

- Species listed in Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) – WCA-1981; and
- Species of special concern and Schedule 2 species, under the Invasive Alien Species (Enforcement and Permitting) Order 2019 – ISO-2019.

2.3.3 Taken together, the relevant legislation makes it an offence to plant, or otherwise cause to grow (including allowing to spread), listed plant species in the wild and, if transported off site, there is a duty of care with regards to the disposal of any part of the plant that may facilitate establishment in the wild and cause environmental harm (as per the Environmental Protection Act 1990). The legislation also makes it an offense to release, or allow to escape, listed animal species (or animal species not ordinarily resident in or a regular visitor to Great Britain in a wild state) into the wild.

2.3.4 While it is not illegal to have listed INNS within a land asset, even when present on managed land (e.g. forming part of landscaping), the spread of listed species should be kept under control such that the species is not having an appreciable adverse impact on habitats and their native biodiversity.

2.3.5 Species of Special Concern should not be kept, bred, transported (unless as part of control action), grown, cultivated, permitted to reproduce, or released into the environment. However, there are exemptions to these requirements where species of special concern have been identified as widespread in England (e.g. Himalayan balsam and signal crayfish). In such cases, steps should be taken to reduce further spread of these species, with localised eradication being carried out in high priority areas where possible, e.g. Sites of Special Scientific Interest (SSSIs), where rare native flora are at threat, and areas at risk of flooding and/or erosion. Management of such species should be based on a cost benefit analysis, which includes an assessment of likely effectiveness and long-term sustainability.

2.3.6 If charged with committing an offence, it is a defence against prosecution to prove that all reasonable steps were taken, and all due diligence exercised in attempting to avoid committing the offence. Therefore, in order to reduce the potential of breaching legislation

and fines/prosecution, a management plan should be in place for INNS on a property and property owners should be able to demonstrate that they are following it.

3 Methods

3.1 Assessment of Previous Reports

3.1.1 No INNS specific field surveys have been carried out, other than for aquatic invertebrates. However, various ecological surveys have been carried out to inform the EIA of the Proposed Development. Both the Phase 1 Habitat Survey Report (Application Document 6.4.6.1) and the Aquatic Ecology Report (Application Document 6.4.6.6) make reference to invasive species.

3.1.2 Relevant INNS information, from the two reports highlighted above, is summarised in Section 4.1.

3.2 Identification of Appropriate Management

3.2.1 A wide range of options are available for the management of INNS (see Appendix B), all of which have been considered in identifying the most appropriate management regime relevant in the context of the Proposed Development.

3.2.2 Where INNS have been identified within the DCO Site Boundary through field surveys, the risk associated with such species is assessed and specific information on the species provided. The following hazards were included in the risk assessment (a letter is assigned to each hazard for reference in Section 4, Table 4-5):

a. Breaches of legislation (failure to observe duty of care), with exposure to prosecution (civil and/or criminal) and fines (unlimited);
b. Delays (with associated financial implications), particularly if INNS are encountered unexpectedly;
c. Control costs, which can increase rapidly in the absence of appropriate mitigation;
d. Potential significant waste disposal costs/issues regarding infested substrate;
e. Spread to other on-site land assets;
f. Spread to off-site properties or habitats (with potential liability, associated control costs and reputational risk);
g. Loss of biodiversity;
h. Loss of amenity;
i. Damage to built structures;
j. Landscape management costs/issues;
k. Health and Safety;
l. Reputational risk;
m. Reduction in property value or difficulty selling assets; and
n. Increased flood risk.

3.3 Limitations

3.3.1 As no INNS specific field surveys have been carried out, other than for aquatic invertebrates, it is possible that further INNS may be present within the DCO Site Boundary, in addition to those identified incidentally during the Phase 1 Habitat Survey or invertebrates identified during Aquatic Ecology surveys.

3.3.2 As such, recommendations are provided for pre-construction surveys and/or surveillance where appropriate.

4 Results

4.1 Assessment of Previous Reports

4.1.1 A summary of the INNS information provided within the Phase 1 Habitat Survey Report (Application Document 6.4.6.1) and the Aquatic Ecology Report (Application Document 6.4.6.6) is presented below.

Phase 1 Habitat Survey Report

4.1.2 The desk study, based upon records retrieved from the Lincolnshire Environmental Records Centre, included nine records of four INNS (plants) from within the DCO Site Boundary and the field survey recorded one species of INNS (plants) within the Survey Area (Table 4-1).

Table 4-1: Desk Study Records of INNS (Plants)

Species	Locations	Number of Records	Study Type
Montbretia *Crocosmia* x *crocosmiiflora*	Grimoldby	1	Desk
Virginia creeper *Parthenocissus quinquefolia*	Mablethorpe	1	Desk
Nuttall's waterweed *Elodea nuttallii*	Louth Canal, Long Eau, Great Eau	7	Desk
Himalayan balsam *Impatiens glandulifera*	North Beck Drain	1	Field

Aquatic Ecology Report

4.1.3 The desk study returned 110 records of eight INNS (plants) from within 2km of the DCO Site Boundary and field surveys recorded one INNS (plant) and one INNS (animal) within the Survey Area (Table 4-2).

Table 4-2: Desk Study Records of INNS (Plants)

Species	Locations	Number of Records	Distance to closest open cut crossing	Study Type
Plants				
Canadian waterweed *Elodea canadensis*	Laceby Beck	29	2.0 km	Desk
	DX007P	1	Within Site	Field
Curly waterweed *Lagarosiphon major*	Glebe Farm	2	0.5 km	Desk
Giant hogweed *Heracleum mantegazzianum*	Tributary of The Cut	2	0.5 km	Desk
Himalayan balsam *Impatiens glandulifera*	Laceby Beck	37	2.0 km	Desk
Japanese knotweed *Reynoutria japonica*	Louth Canal	2	1.5 km	Desk
New Zealand pigmyweed *Crassula helmsii*	Gayton North Fen Drain	2	1.5 km	Desk
Nuttall's waterweed	Laceby	35	2.0 Km	Desk

Elodea nuttallii	Beck			
Water fern *Azolla filiculoides*	Mablethorpe	1	2.5 km	Desk
Animals				
Signal crayfish *Pacifastacus leniusculus*	Two Mile Bank Drain	1	Within Site	Field

4.1.4 In addition to the above species, the desk study and/or field surveys found *Crangonyx pseudogracilis / floridanus*, *Potamopyrgus antipodarum*, *Gammarus tigrinus* and *Oncorhynchus mykiss*; however, these have been abundant nationally for a long time and are now considered naturalised.

4.2 Assessment of INNS identified through field surveys

4.2.1 Relevant traits of the INNS confirmed to be present (i.e. those identified by field survey) within the DCO Site Boundary are summarised in Table 4-3.

Table 4-3: Relevant traits of listed INNS Identified within the DCO Site Boundary

Species	Relevant Traits
Himalayan balsam	Himalayan balsam is listed as a species of special concern under the ISO-2019; however, as the species is considered widespread in the UK, a risk-based approach can be used when determining appropriate control action (i.e. removal is not mandatory). It is an offence to facilitate the spread of this species into the wild. Soil containing Himalayan balsam seeds is considered a controlled waste, necessitating a specific duty of care if such material is removed from a site. However, exemptions are in place that allow such arisings to be managed on site without an environmental permit. Himalayan balsam is an annual plant that spreads and persists via seed. It completes its entire life cycle in one year, dying in winter and re-growing from seeds the following year. This seed bank is relatively short lived, persisting for up to 3 years, usually between 18 and 24 months. As such, if seeds are prevented from being produced for three years, control will be achieved (assuming no pathway for re-introduction is present), after which time no further restrictions are required. The seeds are spread by explosive seeds pods (propelling seeds up to 6 m, e.g. when touched), necessitating its removal from within, or near, works areas. The species also spreads by water flow and in infested soil. New plants can readily sprout from cut stems during the growing season provided the plant remains intact below the first node. Plants removed from the soil can re-root at nodes and regrow. Most Himalayan balsam seeds are located in the top 5 cm of soil; however, it should be assumed that seeds could be present down to 30 cm.
Canadian waterweed	Canadian waterweed is listed on Schedule 9 of WCA-1981, making it an offence to facilitate its spread into the wild. The species is a weakly rooted submerged aquatic plant which grows in water up to 3m deep. The species only reproduces vegetatively in the UK, via small fragments of shoot which spread by water flow and attached to animals, equipment, and vehicles. Where the species becomes dominant it can completely choke up small ponds and can cause drainage/flooding issues by clogging drainage channels in larger waterbodies. Complete removal of aquatic INNS, including Canadian waterweed, is unfeasible in most scenarios. As such, containment through implementation of biosecurity wash down is the primary means by which prevention of spread is achieved.
Signal crayfish	Signal crayfish is listed as a species of special concern under the ISO-2019; however, as the species is considered widespread in the UK, a risk-based

	approach can be used when determining appropriate control action (i.e. removal is not mandatory). It is an offence to release this species into the wild. Signal crayfish is a highly invasive freshwater crayfish. The species can exacerbate soil erosion on riverbanks due to tunneling activity and it spreads the crayfish plague, which is fatal to native white-clawed crayfish. The species spreads by walking/swimming from one waterbody to another and by producing huge quantities of tiny larvae which can spread in water, by water flow and/or attached to vehicles, equipment and clothing. Complete removal of aquatic INNS, including signal crayfish, is unfeasible in most scenarios. As such, containment through implementation of biosecurity wash down is the primary means by which prevention of spread is achieved.

Risk Assessment

4.2.2 The listed INNS identified within the DCO Site Boundary present a risk to the implementation of the Proposed Development and could result in adverse impacts on programme and budget. Budget impacts can escalate quickly in the absence of appropriate mitigation. It is therefore important to respond to infestations as quickly as possible. The risks posed by listed species can be divided into the three categorises shown in Table 4-4.

Table 4-4: Description of Risk Ratings

Species	Relevant Traits
1	**High risk of impact:** Concerted and dedicated action is required to prevent spread and reduce control costs. Control action should commence as far in advance of works as is practical.
2	**Medium risk of impact:** Concerted and dedicated action is required to prevent spread and reduce control costs; however, with forward planning there should be only minimal impact on works.
3	**Low risk of impact:** Avoidance may be possible or control action that eliminates the risk can be integrated into other site activities before or at the onsite of works.

4.2.3 The types of general risks and risk ratings, with respect to the site, that apply to the listed species identified within the DCO Site Boundary are shown in Table 4-5.

Table 4-5: Species, Associated Risks and Risk Rating

Species	Associated Hazards	Rating
Himalayan balsam	a, b, c, d, e, f, g, h, j, l	1
Canadian waterweed	a, f, g, h, j, l, n	3
Signal Crayfish	a, e, f, g, l	3

4.2.4 Himalayan balsam has been assigned the highest risk rating (1) as it is located within the DCO Site Boundary, necessitating management of the species to implement the Proposed Development. Without appropriate management in place, this species can quickly spread around and off site, with associated liabilities and constraints to development/waste-management, which can lead to delays in project programmes and increased associated costs. Given there are 37 records of Himalayan balsam within 2km of the DCO Site Boundary, long term control is unlikely to be feasible due to the high probability of re-introduction from populations which will almost certainly be present upstream. Catchment level control programmes would be required to achieve long term control. As such, control should focus on minimizing the potential for the Proposed Development to facilitate spread over the construction period by managing the species within, and in close proximity to, works areas.

4.2.5 Canadian waterweed and signal crayfish have been assigned a low risk rating (3) as the Proposed Development only interacts in a limited way with aquatic habitats (e.g. all main

rivers are crossed using trenchless techniques) and since associated risks can be mitigated by following best practice with respect to works in aquatic habitats (i.e. implementing clean, check, dry protocols (or equivalent) – see Table 5-4). Steps must be taken to prevent the spread of these species between waterbodies along the Proposed Development, through biosecurity implementation aimed at containment. Containment of signal crayfish is of particular importance due to it being listed as a species of special concern under IAO-2019. The local control of these aquatic species is not practically implementable (the removal of aquatic INNS from aquatic habitats typically requires the destruction, and recreation, of the habitat), and, due to their widespread nature in the wider environment, rapid recolonization would be a certainty regardless.

Pathway Analysis

4.2.6 Based on the limited information currently available, the INNS identified were likely introduced to the area primarily by water flow. Waterways are a key pathway for the spread of INNS, and many waterways transect the Site. Even where local control is possible and achieved on site, this pathway would remain, creating a high risk of re-introduction.

4.2.7 It is probable that additional occurrences of INNS will be present beyond those already identified. Regionally widespread species, which spread by water flow, are the most likely to be present elsewhere, such as Himalayan balsam.

4.2.8 Another key pathway, highly relevant to the Proposed Development, is accidental spread of INNS attached to vehicles, equipment and footwear. Regarding the INNS identified within the DCO boundary, Himalayan balsam seeds readily spread within infested soils. Additionally, fragments of Canadian waterweed and signal crayfish juveniles can easily be transferred through adherence to vehicle bodies, tyre treads and tracks.

4.2.9 The primary pathways through which these species can be spread on/around/off the site are summarised in Table 4-6.

Table 4-6: Primary Pathways of Spread for INNS Identified and Risk Category

Spread	Propagules attached to footwear	Propagules attached to equipment or vehicles	Natural spread onto the Site
Himalayan balsam	● High risk during development, via seed infested soil (especially where soil is disturbed, and access is not restricted)	● High risk during development, via seed infested soil (where equipment/vehicles are used in infested areas)	● High risk, via seed, including due to water flow, as Himalayan balsam is widespread in the wider environment
Canadian waterweed	● Moderate risk during development, via shoot fragments (where water is entered)	● High risk during development, via shoot fragments (where equipment/vehicles are used in infested waterbodies)	● High risk, via waterflow, as Canadian waterweed is widespread in the wider environment
Signal crayfish	● Low risk during development, via larvae (where water is entered)	● High risk during development, via larvae (where equipment/vehicles are used in infested waterbodies)	● High risk, via waterflow, as Canadian waterweed is widespread in the wider environment

5 Outline Biosecurity Management Plan

5.1.1 This Outline BMP will be updated as required (i.e. where additional INNS are identified). The information below is presented at a high level and constitutes an outline plan for how

identified INNS will be managed under different scenarios. A location specific Action Plan, or Method Statement, will be produced, prior to development works commencing in a given area, for each occurrence of terrestrial INNS identified within the DCO Site Boundary. Such Action Plans will be location and task specific, will specify the precise actions to be taken in a given location (in line with this Outline BMP), and will include an accurate distribution map, with species appropriate buffer zones, for the INNS.

5.1.2 Additionally, the protocols specified below, for working in aquatic habitats, will be integrated into the Method Statements for all works that interact with aquatic habitats.

5.2 Objectives

5.2.1 This Outline BMP has four main objectives, which are to:

- identify, and respond to, additional INNS risk (beyond those currently known);
- determine feasible mitigation for identified INNS and specify how it should be applied;
- minimise INNS related environmental, waste, carbon, and cost impacts; and
- ensure compliance with legislation and industry good practice.

5.3 Identification of Appropriate Management Options

5.3.1 A wide range of options are available for the management of INNS, all of which have been considered in identifying the most appropriate management regime relevant in the context of the Proposed Development. All options have been considered in the context of the risk and pathway analyses carried out in Section 4. See Appendix B for the list of appraised control options.

5.3.2 Based on an assessment of all control options, the optimal approach to managing the INNS identified within the DCO Site Boundary will involve a combination of:

- pre-development surveys and response (i.e. Action Plan production);
- avoidance measures and biosecurity implementation;
- herbicide treatment / hand pulling / strimming;
- excavation, temporary stockpiling, and re-use of arisings (potentially); and
- monitoring and remedial response.

5.3.3 Section 5.4 provides information of the general requirements when working in areas infested with INNS.

5.3.4 Tables 5-1 and 5-2 provide an overview of the recommended management options for each species.

5.3.5 Table 5-3 to Table 5-6 provide details on the recommended mitigations.

5.3.6 Additional details, and useful information, are provided in Appendix B to E.

5.4 General Requirements

5.4.1 An INNS specialist should be appointed for the Proposed Development, with the primary tasks associated with the role being:

- updating this BMP (as required);
- providing advice on how best to implement required controls, while minimising environmental, waste, carbon, and cost impacts;
- producing location specific Action Plans or Method Statements; and

- reviewing contractor method statements (where works interact with INNS risk).

5.4.2 An INNS specific walkover survey should be carried out prior to development works in an area. This is particularly important where a land parcel contains water features. The walkover survey should be carried out as far in advance of development works as is practical. Advanced warning of INNS presence can allow actions to be taken that result in significant reductions in environmental, waste, carbon, and cost impacts.

5.4.3 For locations where terrestrial INNS have already been identified, an INNS specific survey should be carried out to map the distribution of the species, which will be needed to inform the production of an associate Action Plan or Method Statement.

5.4.4 Areas infested with INNS should be demarcated, including a species appropriate buffer-zone, using fencing and signage.

5.4.5 Anybody likely to enter an area where INNS are present should be informed of the presence and associated restrictions.

5.4.6 Contractor's method statements for works within INNS infested areas should ensure compliance with the protocols set out within this document (in particular Table 5-4). Contractors involved in such works should liaise with the appointed Viking CCS Pipeline INNS specialist, who should validate that all Method Statements include appropriate biosecurity protocols and ensure current industry good practice is followed.

5.4.7 Where treatment of INNS is required, *in situ* treatment (e.g. using herbicide or hand pulling), is preferable to excavation-based remediation. Ideally, such treatment should commence as far in advance of the onset of development works in a location, so as to optimise the potential for minimising environmental, waste, carbon, and cost impacts.

5.4.8 All works involving the management of INNS should be carried out by an appropriately qualified specialist or be overseen by an appropriately experienced Environmental or Ecological Clerk of Works (ECoW) who is trained in the management of INNS. Specifically, the ECoW Should be:

- expert in the identification of the INNS identified, included above and below ground material, prior to and following herbicide treatment (demonstratable); and
- suitably experienced overseeing INNS remediation and the implementation of required biosecurity protocols (demonstratable).

5.4.9 INNS management works must conform to the requirements set out in 'Regulatory Position Statement 178 - treatment and disposal of invasive non-native plants' (Environment Agency, 2019).

5.4.10 On-site treatment and re-use (e.g. as backfill or topsoil) of INNS arisings (e.g. soil infested with INNS seeds) is preferable, as opposed to off-site disposal, as per Environment Agency guidance, and is the recommended approach where possible. If INNS waste is being disposed of off-site (which is currently assumed to be avoidable), it must be disposed of at a suitably licenced waste disposal facility, and be transported by an appropriately licensed waste carrier.

5.4.11 Records of all INNS related control action should be maintained, with the goal of being able to demonstrate compliance with this Outline BMP, and therefore industry good practice and legislation. The Biosecurity Implementation Record (BIR) proforma, or equivalent, provided in Appendix D should be completed as part of the compliance processes.

5.4.12 Monitoring and response (e.g. herbicide treatment of regrowth) are integral parts of INNS management and should be implemented for the duration of the Proposed Development in areas where INNS have been identified (see Table 5-6). As per The Great Britain Invasive Non-native Species Strategy, prevention though surveillance and rapid response is considered the most cost-effective approach to INNS control, rather than allowing issues to

escalate undetected followed by the requirement for large scale control action.

5.4.13 Further to the biosecurity protocols described in Table 5-4, the following biosecurity requirements should be implemented site wide (to reduce the potential of introducing INNS to the site):

- vehicles (including tyres and tracks), equipment, and PPE that are brought:
  - onto the wider site, should be clean and free from soil, mud and other contaminants; and
  - into aquatic habitats, should have been subjected to clean, check, dry protocols (or equivalent, also see Table 5-4), prior to arrival at site.
- conformance to British Standards for topsoil brought on site, i.e. BS3882:2015, which specifies it must be free of INNS propagules.

5.5 Change Management

5.5.1 Any new INNS identified, e.g. new stands identified following vegetation clearage, should be recorded and added to the Outline BMP.

5.5.2 A chain of communication should be established for relaying management records, BMP deviations, and new risk to the relevant party, i.e. the appointed INNS specialist (who should be identified in advance of works), so that records can be centralised, and the BMP updated.

5.6 Optimal Management for Identified INNS

5.6.1 Table 5-1 provides an overview of the recommended management option for each species. In the context of Table 5-1, 'disturbed' refers to INNS, including species-specific buffer-zones, located within land required for any ground-breaking works, including temporary works and/or materials storage areas, i.e. any INNS within the land required for development works and associated activities. 'Undisturbed' in this context refers to INNS, including species-specific buffer-zones, which are located within the boundary of the Site, but which are located outside of land required for construction works and associated activities.

Table 5-1: Optimal Management Options per Species

Species	On -site, disturbed	On-site, undisturbed	Off-site (within 10 m)	Off-site (beyond 10 m)
Himalayan balsam	Control action (i.e. herbicide treatment or hand pulling) as far in advance of development as is practical, and monitoring. If control has not been achieved prior to the onset of development works, implementation of biosecurity protocols, excavation of infested soils, temporary stockpiling, re-use as backfill, and monitoring.	Avoidance and control action (i.e. herbicide treatment or hand pulling), and monitoring.	Avoidance and control action (i.e. herbicide treatment or hand pulling), and monitoring - if access and permission is granted.	Avoidance
Nuttall's Waterweed	Avoidance or containment through biosecurity implementation.	Avoidance	Avoidance	Avoidance

Signal Crayfish	Avoidance or containment through biosecurity implementation.	Avoidance	Avoidance	Avoidance

5.7 Details of Optimal Management

5.7.1 Table 5-2 provides further details on the recommended control action, and the associated rational behind those recommendations.

5.7.2 The details required to implement the optimal management summarised in Table 5-1 and 5-2 are presented in Tables 5-3 to 5-6.

Table 5-2: Recommended Management

Species	Recommendations and Rational
Himalayan balsam	A 6 m buffer-zone should be established around Himalayan balsam plants (also see Table 4-3), as this is the distance from parent plants to which seeds may have been propelled. Control action (Table 5-3) should commence for Himalayan balsam as far in advance of development works as possible, with the goal of achieving three years without seed production prior to the onset of development. Even where there is insufficient time to achieve control in advance of development, control action should still be undertaken, so as to minimise the presence of the species. Where there is insufficient time to achieve control in advance of development works, the following action will be required: • biosecurity protocols (Table 5-4) will need to be implemented when working within Himalayan balsam buffer-zones; and • where a pipe is being installed through an area with Himalayan balsam the seedbank (top 30 cm of soil) should be excavated along the route of the pipe, temporary stockpiling, and re-instated/re-uses, i.e. as topsoil or backfill (Table 5-5) following the installation of the pipe. Alternatively, when working in an area infested with Himalayan balsam, the seedbank (top 30 cm), can be stripped from the entire working area and temporarily stockpiled. Works can them proceed without restriction within the area from which the seed bank was stripped. The stockpiled material can then be re-instated/re-used as topsoil following the works.
Nuttall's Waterweed and Signal Crayfish	It is not recommended to attempt the local control of fully aquatic INNS, other than containment through implementation of biosecurity protocols, as achieving such control is generally not realistically feasible. See Table 5-4 for the details of required biosecurity.

5.7.3 Table 5-3 provides details on the recommended control actions for each species (where control has been recommended), along with timings, frequencies, and durations. Appendix C provides additional information on industry good practice for herbicide treatment.

Table 5-3: Details of recommended control action

Species	Details of control action
Himalayan balsam	Herbicide treatment is typically the most pragmatic option for Himalayan balsam control, as large areas can be rapidly treated, and extension lances can be used to treat plants in harder to reach locations (e.g. steep waterbody margins). Himalayan balsam can also be effectively controlled using hand pulling (the species is weakly rooted), which can be useful for smaller stands or towards the end of treatment programmes. Pulled plants should be pilled, with the pile monitored for growth. Alternatively, pulled plants can be wrapped in tarpaulin, or

	bagged, to accelerate decomposition. Strimming/mowing can also be used to control Himalayan balsam; however, it is essential that plants are cut below the first node. Failing to do so will result in regrowth and prolific seeding. Regardless of the method used, the following timings, frequencies, and durations should be used: • Years 1 and 2: 3x treatments per year, with 2 months between each treatment, commencing in May/June. • Year 3 +: 2x treatments per year, in May/June and August/September. • Control can be considered complete when seeds have been prevented from being produced for 3 years.

5.7.4 Table 5-4 provides details on recommended biosecurity implementation for each species, or group of species.

Table 5-4: Details of recommended control action

Species	Biosecurity Protocols
	Biosecurity Zone Set Up
Terrestrial Environments: Himalayan balsam	Prior to works on an infested terrestrial land a Biosecurity Zone should be set up that restricts movement between locations with INNS risk and locations without INNS risk. The minimum size of the Biosecurity Zone is defined by the buffer zone requirements for a given species: • Himalayan balsam: 6 m Biosecurity Zones should be clearly demarcated with appropriate signage (see Appendix E for an example). Fencing should be installed prior to Site works commencing using, as a minimum, mesh barrier fencing (but ideally heras fencing). Consideration must be given to preventing wildlife becoming trapped within fenced areas. Prior to works within a biosecurity zone, a toolbox talk must be provided by a suitably trained/qualified individual (familiar with the contents of this BMP) at the onset of works, with attendance being recorded, providing details on identification, location and the required biosecurity precautions. All personnel should be reminded of biosecurity requirements at daily briefings. In order to reduce the accumulation of soil and the need for washdown, vehicles should ideally entre biosecurity zones free of soil (this will make identifying and removing INNS contamination much easier). Where soil disruptive works are not required within a biosecurity zone (or part thereof), or vehicles and/or personnel need to move through the zone to access other parts of the Site, soil protection (e.g. track matting with a polythene/geotextile layer below) can be used to create an access route through the biosecurity zone or a working platform within the biosecurity zone. Soil protection must be sufficiently robust to withstand the development related activities to be carried out in a given area, with appropriate steps being taken to prevent damage (which should be assessed on a case-by-case basis by a suitably qualified ECoW). If soil needs to be levelled to allow soil protection to be installed, any potentially infested arisings generated should be retained within the biosecurity zone and biosecurity protocols must be followed with respect to washdown. Where soil protection does not mitigate all risk, cleaning stations must be set up at designated locations, e.g. entry/exit points, or where vehicles, positioned on soil protection, need to come into contact with soil (e.g. GI

	rigs or excavators). More than one cleaning station can be set up per biosecurity zone if useful and practical to do so. At each cleaning station suitable equipment must be available to clean affected equipment/plant, footwear, and tools, for example: • a jet wash, or equivalent (e.g. for vehicle tires/tracks), or wheel wash; • hard bristled brushed and spades (e.g. for excavator buckets or drill bits); and • brushes, hoof picks, hand sprayers, flexi tubs etc. (e.g. for footwear and equipment). Soil conditions will affect equipment requirements, e.g. dry versus wet soils or presence of firmer ground. Appropriate precautions must be taken to capture biosecurity arisings, which should be retained within the biosecurity zone. For example, equipment that has come into contact with infested soils, should be cleaned over a tarpaulin (or equivalent – see example in Appendix E), which can then be shaken off into the adjacent biosecurity zone. Alternatively, if practical, such equipment can be cleaned off directly over a biosecurity zone (e.g. excavator buckets – see example in Appendix E). The potential for other runoff, including, for example, any potential contaminants caked to vehicles, should be managed appropriately. This may require specific risk assessment and mitigation, depending on the vehicles being used (e.g. if there is the potential that hydrocarbons could be washed off into the soil). Defining such precautions, should they be required, is outside the scope of this document.
Aquatic Environments: Nuttall's waterweed Signal crayfish	Avoiding contact with aquatic environments is optimal. Where contact cannot be avoided, washdown stations should be set up at exit points from waterbodies. Signage should be installed to inform personnel of biosecurity requirements. The following equipment should be made available, with respect to INNS biosecurity (see example in Appendix E): • a jet wash (or steam cleaner), ideally capable of expelling water at temperatures greater than 60 degrees centigrade; • hand sprayers, brushes, hoof picks, and flexi tubs, or a boot wash, should be available for footwear and smaller equipment. • fresh water (not sourced from infested waterbodies); Appropriate precautions must be taken to capture biosecurity arisings, which should be retained within the infested waterbody. The potential for other runoff, including, for example, any potential contaminants caked to vehicles, should be managed appropriately.
	Biosecurity Implementation
Terrestrial Environments: Himalayan balsam	Wash down is not required when working within a biosecurity zone if: • soil protection is installed; and • all plant and personnel, can and do keep to it; and/or • no contact is made with soil. However, the following precautions are required: • The integrity of the soil protection should be regularly inspected (i.e. on a daily basis during periods of activity). Where damage is identified, the area should be fenced off until the damage is repaired. Materials for fencing and repair should be made available. • Soil protection will be kept reasonably clean (e.g. significant soil accumulation should be prevented), so that damage to geotextiles can be identified (if there is a reasonable probability that damage could occur). This step is not required if soil protection is designed to

	be suitably durable. • Where vehicles are positioned on soil protection, but a part of the vehicle (e.g. excavator bucket or drill bit) comes in contact with potentially infested soil, the part of the vehicle that comes in contact with the soil must be cleaned prior to use in un-infested areas, with arisings being returned to biosecurity zones. The following biosecurity measures must be implemented when working within INNS biosecurity zones, where contact with potentially infested soil is made beyond that described above: • Where possible, disturbed soil/ground within the biosecurity zone should be avoided and vehicles should be kept as clean as is practical, with soil ideally being prevented from accumulating on plant and equipment, e.g. through use of soil protection or by keeping to firmer ground. • Before exiting a biosecurity zone, vehicles (including tyres and tracks), equipment and footwear must be cleaned and free from soil and plant material. • Regarding plant and equipment, an inspection should be made by an appropriately qualified ECoW or suitably informed individual. A record should be made of inspections, with the aim of ensuring demonstratable compliance with the BMP, i.e. through the completion of the Biosecurity Implementation Record proforma (Appendix D), or equivalent. • Regarding footwear, all personnel must inspect their footwear and remove soil and plant material when present when exiting a biosecurity zone. Periodic quality assurance audits should be carried out to confirm compliance, with records of such audits being made and retained, i.e. through the completion of a Biosecurity Implementation Record proforma (Appendix D). Additionally: • If soil samples are taken during the works from within a biosecurity zone down to a depth of 30 cm, they must clearly be labelled as potentially containing INNS (e.g. if working in a Himalayan biosecurity zone). Soil test facilities should be contacted in advance to confirm that they have the capability to dispose of soil containing INNS material following the appropriate duty of care, once such samples enter waste streams.
Aquatic Environments: Nuttall's waterweed Signal crayfish	Steps should be taken to minimise the amount of equipment that comes into contact with water. Works can proceed without restrictions relating to INNS over water where no contact is made with the water (i.e. equipment located on and/or personnel working on floating pontoons). Regular movement between waterbodies should be minimised, i.e. where possible plant and equipment should be used within a single water body until works are completed in that water body. If relevant, works in water should progress from ‘upstream’ to ‘downstream’ where possible to minimise the potential for accidental spread against the direction of water flow. All vehicle, materials, equipment or PPE/clothing that comes in contact with water must be subjected to appropriate biosecurity washdown. When moving between waterbodies, or away from the site all vehicle, materials, equipment or PPE/clothing that were in contact with water must be assessed for capacity to facilitate INNS propagule spread, and proportionate biosecurity measures should be implemented. The following criteria should be used: o High risk items, such as pontoons (or other large items with

	many nooks and crannies), should be inspected by an ECoW to ensure sediment or plant material is removed where encountered. Such equipment should be sprayed down (e.g. by jet wash, or steam cleaner, ideally capable of expelling water at temperatures greater than 60 degrees centigrade). Where hot water cleaning is not possible, such items should be completely dried before use in another waterbody. o Moderate risk items, e.g. excavator buckets (or other items with smooth surfaces that are easily inspected), should be inspected by an ECoW to ensure sediment or plant material is removed where encountered (e.g. by jet wash). o Low risk items, e.g. footwear, should be cleaned by site personnel at washdown stations. Periodic quality assurance audits should be carried out to confirm compliance, with records of such audits being made and retained. Equipment arriving onsite should have been completely dried, steam cleaned, or disinfected (e.g. with a detergent such as Greenclean) prior to arrival on-site. Where detergent is used, it should be used at the contractor's compound (rather than onsite) and equipment should be brought to site clean and dry, i.e. with no residue. The same will apply when the equipment is returned to a contractor's compound, prior to use elsewhere. If all steps cannot be completed on site, then residual steps can be completed at an external compound prior to use in another site. Evidence of offsite bio-secure washdown capabilities must be provided in advance.

5.7.5 Table 5-5 provides details on the protocols, other than those associated with biosecurity, which is covered above, that should be employed where excavation must take place in infested soils.

5.7.6 Waste reduction is importance where excavations are required. As per Regulation 12 of the Waste (England and Wales) Regulations 2011, it is a legal requirement to take all such measures as are reasonable in the circumstances to apply the waste hierarchy to prevent waste, and to apply the hierarchy as a priority order (i.e. prevention, re-use, recycling, other recovery, and finally disposal). All Waste Transfer Notes must confirm that this legal requirement has been abided by before waste is transferred from a site. As such, it is essential that all due diligence is exercised, with respect to waste reduction.

Table 5-5: Details of recommended control action

Species	Excavation
Himalayan balsam	In all cases the aim should be to minimising waste creation, e.g. by minimising the quantity of soil excavated and retaining and re-using arising from such works onsite whenever possible. When installing a pipe through a Himalayan balsam biosecurity zone, the soil along the top of the required trench should be stripped down to 30 cm (i.e. the depth of the seed bank). The excavators required for such works would ideally sit on soil protection (e.g. track matting underlaid with polyethene sheets or geotextile), as detailed in Table 5-4. The stripped soil should be stockpiled locally, ideally within the same biosecurity zone. When the pipe has been laid, and the trench is being backfilled, the stockpiled soil can be used as backfill. Ideally, the stockpiled soil should be used as topsoil, which will help retain soil stratification. All Biosecurity Protocols, as described in Table 5-4, should be followed. A watching breid should be carried out by a suitably qualified ECoW during such

	works. If required, a larger area of infested topsoil, e.g. across the working width of the Proposed Development (i.e. 30 m), can be stripped, to facilitate 'free' movement within the working area around pipe trenches. This in turn will necessitate a larger area to stockpile the infested arisings. As such, it is likely preferable to minimise the quantity of infested soil excavated. If soils are to be stockpiles for longer than 12 months, INNS growth from the stockpile must be treated (i.e. subjected to control action following the protocols specified in Table 5-3).

5.7.7 Monitoring is a critical component of INNS management and is required during and following control action (both herbicide and excavation based). Additionally, due to the presence of a range of spread pathways outside the control of Viking CSS (e.g. spread due to water flow, animal activity, etc.) surveillance should be carried out periodically across the wider site (i.e. including area outside known presence).

5.7.8 The post control monitoring requirements and surveillance recommendation are outlined in Table 5-6. Monitoring/Surveillance must be combined with appropriate response protocols, the requirements for which are also outlined in Table 5-6.

Table 5-6: Monitoring and Response

Species	Recommendations
	Monitoring/Surveillance
Himalayan balsam	An INNS specific survey should be caried out at the location where Himalayan balsam has already been identified, i.e. North Beck Drain. During implementation of control action, areas infested with Himalayan balsam should be monitored until three full growth seasons (i.e. essentially three years) have passed without seeds being produced. Monitoring should be integrated into control action where possible. Site ECoWs should regularly inspect the integrity of fencing around Himalayan balsam biosecurity zones and keep an eye out for Himalayan balsam in general (in case accidental spread of seeds occurs along the route). Given the number of records of Himalayan balsam within 2km of the DCO site boundary, new introductions to areas adjacent to water and/or in areas prone to flooding, is likely due to the ease by which Himalayan balsam spreads by floating seeds. Accordingly, waterways that transect the site should also be surveyed for INNS.
Other terrestrial INNS records within the DCO Site Boundary.	An INNS specific survey should be caried out at the location where montbretia (i.e. Grimoldby) and Virginia creeper (Mablethorpe) were previously recorded (Table 4-1).
	Response
Himalayan balsam	For Himalayan balsam at North Beck Drain, the distribution of the species should be mapped, along with an appropriate buffer zone, and an Action Plan should be produced, which specifies the precise mitigation actions to be taken (in line with this BMP). Where monitoring identifies regrowth in an area undergoing control action, it should be recorded and control action continued. When monitoring/surveillance identifies growth outside of known distributions, it should be recorded and the area should be fenced off until an inspection can be carried out by a suitably qualified specialist. The plants should be added to the control programme, with control being implemented as quickly as possible. Recently established INNS are typically easy to control.

	A key component of rapid response is having funds available to commission new control work in a timely fashion. As such, it would be pragmatic to have contingency funding in place to support such works.
Other terrestrial INNS records within the DCO Site Boundary.	If montbretia and/or Virginia creeper are found to be location within the DCO Site Boundary, the distribution of the species should be mapped, along with an appropriate buffer zone, they should be added to this BMP and an Action Plan should be produced, which specifies the precise mitigation actions to be taken (in line with this BMP).

Appendix A – Legislation Additional Information

Table A-1: Summary of Relevant Legislation Relating to INNS

Legislation	Summary of Key Aspects
Invasive Alien Species (Enforcement and Permitting) Order 2019 (as amended)	This legislation imposes restrictions on species of animals and plants in Schedule 2 of the Act or listed as 'Species of Special Concern'. These are species which pose a risk of adverse impacts across the UK and EU, such that targeted action across the UK and EU is required. Restrictions applying to these species mean they cannot not be imported, kept, bred, transported, sold, used or exchanged, allowed to reproduce, grown or cultivated, or released into the environment. Under certain circumstances a Species Control Order can be served on a landowner to require the removal of a given species (see Infrastructure Act 2015). The UK has produced an FAQ document for UK stakeholders outlining the key aspects of the legislation and the obligations of stakeholders in relation to the species on the list of species of special concern. This document states that if the containment of plant species of Special concern cannot be guaranteed, their safe removal should be considered. There are exemptions to these requirements where species of special concern have been identified as widespread in England. However, in such cases, steps must be taken to minimise their impact on native habitats, where management is feasible. Additionally, steps should be taken to reduce further spread of these species, with localised eradication being carried out in high priority areas where possible, e.g. Sites of Special Scientific Interest (SSSIs), where rare native flora are at threat, and areas at risk of flooding and/or erosion. Management of such species should be based on a cost benefit analysis, which includes an assessment of likely effectiveness and long-term sustainability.
Wildlife and Countryside Act 1981 (as amended) Schedule 9, Section 14	It is an offence to plant or otherwise cause to grow in the wild any listed plant species. It is an offense to release, or allow to escape, listed animal species (or species not ordinarily resident in and is not a regular visitor to Great Britain in a wild state) into the wild. Defra have produced guidance on Section 14 in order to help with the interpretation of the above. Relevant text from the guidance includes: "We consider that planting in the wild would constitute intentionally placing viable plant material in or on suitable medium so that it can grow." "We would not consider planting on managed land, where it is expected that the spread of the plant will be kept under control, and where the plant is not having an appreciable adverse impact on habitats and their native biodiversity, as planting in the wild. "It is our view that for a species to be considered 'ordinarily resident', the population should have been present in the wild for a significant number of generations and should be considered to be viable in the long term." "We consider 'release into the wild' to be the active letting go of an animal, from a condition of captivity, such that it has the freedom to go where it will. In essence, we consider that the deliberate introduction of an animal into an area considered to be 'the wild' would be an act of release."

Infrastructure Act 2015	Environmental authorities may issue control orders under which landowners can be obligated to carry out species control operations for INNS animal and plant species.
Anti-social Behaviour, Crime and Policing Act 2014 and Community Protection Notices	Local councils and the police have the power to issue Community Protection Notices against “individuals who are acting unreasonably and who persistently or continually act in a way that has a detrimental effect on the quality of life of those in the locality” including for INNS. Breach of any requirement of a Community Protection Notice, without reasonable excuse, would constitute an offence. Guidance released by the Home Office provides information on the reformed Anti-social Behaviour, Crime and Policing Act 2014. The guidance note, primarily aimed at Japanese knotweed, giant hogweed and Himalayan balsam, provides information on how best to proceed if a neighbour is unwilling to control INNS on their property, i.e. they will not treat it with herbicide or remove it. The updated legislation means that if a neighbour ‘fails to act’ regarding controlling, or preventing the growth of INNS, then a Community Protection Notice can be issued requiring action to be taken. Breach of any requirement of a Community Protection Notice, without reasonable excuse, would be a criminal offence, subject to a fixed penalty notice (which attracts a penalty of £100) or prosecution. On summary conviction, an individual would be liable to a level 4 fine (£2,500). An organisation, such as a company, is liable to a fine not exceeding £20,000.
Environmental Protection Act 1990, Sections 33 and 34	If taken away from the site of origin, listed species and associated material, e.g. soil, may be classified as Controlled Waste and must be disposed following a duty of care. Such waste that is disposed of off-site must be accompanied by appropriate waste transfer documentation and be transported by an appropriately licence waste carrier.
Town and Country Planning Act 1990	Although this Act does not make specific reference to specific weeds, it provides local authorities with power to serve notices on owners or occupiers of land to control weeds that may be harming the amenity of the surrounding area. If the owners and occupiers fail to remedy the situation, they may be liable to a fine or have to repay the costs of action taken by the local authority to control the weeds.
Common Law	There is precedent within Common Law to take civil action against neighbouring landowners where the spread of invasive species is considered to be a private or public nuisance. This is particularly relevant where Japanese knotweed is located on land assets adjacent to residential properties.

Appendix B – INNS MANAGEMENT OPTIONS

A wide range of options are available for the management of INNS (see below), all of which should be considered in identifying the most appropriate management regime relevant in the context of a given location. All options should be considered in the context of the risk and pathway analyses.

The options outlined below are based on a range of guidance documents that have been produced by the Environment Agency, the Property Care Association, and various other local, regional, and national agencies and stakeholders in a range of countries.

The various control options, that can be used in isolation or in combination, are listed below:

a) Exclusion and biosecurity implementation: the use of fencing, soil protection and biosecurity washdown to control species and prevent spread.

b) Herbicide treatment: Spraying the affected area with chemicals, achieving control over a period of around 1 to 5 years (depending on species, maturity and area covered).

c) Crown removal and herbicide treatment (Japanese knotweed only): When treating Japanese knotweed with herbicide a large amount of the active chemical is absorbed by this dense crown material (if present), which can reduce the amount of herbicide that reaches buried rhizome and can greatly increase the time required for control. These crowns can be removed prior to herbicide treatment.

d) Physical removal using hand pulling: Removal of plant material by gently pulling plants by hand (not suitable for Japanese knotweed).

e) Physical removal using hand tools: Removal of plant material using spades and soil forks (generally not suitable for Japanese knotweed).

f) Physical removal using machinery: Large scale removal of plant material and associated soils using heavy machinery.

g) Light exclusion: Plant material can be covered using a light impermeable barrier (e.g. polythene) or a semi-impermeable physical barrier (e.g. jute matting) resulting in destruction of the plant material or prevention of germination (not suitable for Japanese knotweed).

h) Draw-down: Water bodies are drained, and plant material is left to dry out and die. Can be combined with herbicide application. Water bodies are subsequently re-filled. Only suitable for aquatic plants.

i) Biological control: A biological control agent (e.g. fungus or insect) is introduced to a habitat and eats of kills/damages the target species (non-target species are not affected).

j) Root barrier membrane (Japanese knotweed only): Prevents the horizontal growth of Japanese knotweed by installing a vertical membrane barrier. This is usually used on site boundaries to prevent underground rhizomatous spread from neighbouring sites. A thin trench is dug, and the barrier is installed to a depth of around 3 m. The membrane should be reinforced with plywood before backfilling takes place.

The various options for management INNS arisings, that can be used in isolation or in combination, are listed below:

a) Re-use under a Materials Management Plan.

b) Stockpiling: Moving excavated material to an area of the Site where it can be treated with chemicals over a period of approximately 1 to 3 years. After this, soil can be left in situ and landscaped or re-used on Site.

c) Screening (Japanese knotweed only): Excavating the Japanese knotweed stands and screening or sieving the material (e.g. through a 25 mm mesh) to remove the larger rhizome fragments, which are then handled (e.g. incinerated) in an approved manner. The material containing the

smaller rhizome fragments, which passed through screening, is then further managed (e.g. treated with herbicide) in a controlled area on the Site. As the Japanese knotweed is re-growing from small rhizome fragments, the time taken to achieve eradication is reduced.

d) Burial: excavating impacted soils and burying the material on Site. Some restrictions may apply both where material can be buried and what can happen above the buried area.

e) Disposal as green waste: Some plant material (species dependant) can be taken off Site and disposed of as green waste for composting or incineration.

f) Removal to landfill: Excavating impacted soils stands and removing the material to a landfill registered to receive such waste using covered haulage vehicles.

A summary of the advantages and disadvantages of each of these control options is presented in Table A-2.

Table B-1: Evaluation of the Advantages and Limitations of Potential Mitigation Options

Option	Option summary	Advantages	Limitations
Fencing to create biosecurity zones -different potential arrangements of fencing are detailed below	Installation of exclusion fencing to demarcate the location of INNS, with works within biosecurity zones requiring biosecurity implementation	• Reduces the probability of accidental disturbance and spread. • Allows the location of INNS to be easily identified. • Can be combined with soil protection to reduce washdown requirements (see below).	• No significant disadvantage. However, there are costs involved and maintenance is required.
Soil protection	Use of geotextiles on soil, coupled with protection and/or a suitable working surface, to prevent disturbance of infested soils	• Protect soils from disturbance. • Allows movement through biosecurity zones without the implementation of washdown.	• Geotextiles will need to be protected to prevent damage and a suitable working surface installed. • Can be impractical or expensive at larger scales. • Ground may need to be levelled in advance.
Washdown (terrestrial)	Use of washdown stations at exit points from biosecurity zones	• Prevents soil from being spread away from biosecurity zones. • Works within biosecurity zones can be carried out with minimal disruption.	• Depending on the soil conditions within a biosecurity zone, the frequency of movement across biosecurity zone boundaries, and the type of vehicles/equipment being used, washdown can be very labour intensive.
Washdown (aquatic) – check, clean, dry	Use of washdown stations on exit from infested waterbodies	• Allows works to be carried out in infested waterbodies, environments where the removal of INNS in advance is typically not viable. • Cost effective. • Heat treatment (also see below) can be	• Depending on the frequency of movement away from waterbodies, and the type of vehicles/equipment being used, washdown can be very labour intensive. • Removing all viable propagules can be extremely difficult, especially the larval/juvenile stage of

		used to increase effectiveness.	invertebrates which can be microscopic. This is less of an issue for plant fragments, which are typically easier to see and remove. • Allowing equipment to become fully dry on Site, especially in wetter/colder month, may not be possible. • Many INNS are tolerant to drying out and can survive drying conditions for extended periods (days / weeks).
Washdown (aquatic) – heat treatment	Incorporation of heated water into washdown protocols	• Experiments have shown that water heated above 40 degrees centigrade is an effective method for killing various INNS animals, e.g. zebra mussel. • Experiments have shown that water heated above 60 degrees centigrade is an effective method for killing various INNS plants, e.g. New Zealand pigmyweed.	• Heating sufficient quantities of water on Site may not be practical. • Carbon intensive. • Cost intensive. • In the lower temperature range, longer periods of contact are required. • Water cools quickly on exit from applicators.
Silt curtains	Installation of silt curtains around aquatic working areas	• Can help capture INNS plant fragments, if created within works areas. • Potentially will be being used regardless of INNS presence.	• Silt curtains will need to be thoroughly cleaned or disposed of. • No long-term benefit to INNS control in the waterbody will be realised.
Herbicide treatment	Application of herbicide to terrestrial INNS	• Cost effective • Treatment can be carried out in situ without risk of spreading plants further • Reduces the risk of accidental spread if stands are treated prior to excavation based remediation	• Stands typically need to be treated over 1-5 years depending on the species • The area may need to be left undisturbed. • Restrictions can remain on Site. • Restricted use near valuable vegetation and waterways.
Screening	Screening or sieving soil to remove rhizome material	• Reduced the organic content of arisings • Regrowth from small fragments is typically easier to treat with herbicide, potentially reducing the time required for	• Only reduces the level of infestation; smaller fragments will remain in the soil • Arisings must still be managed as infested • Specialist equipment required to sieve soil, which

		eradication.	can only be used in certain soil types • Not specialist equipment can be used to remove the majority of rhizome in clay soils (in a similar fashion to tree roots), but this will be less effective that sieving
Crown removal (Japanese knotweed only)	Removal of crown and shallow rhizome material	• Removes the vast majority of underground biomass • Increases the effectiveness of herbicide treatment • Reduces the time required for herbicide treatment	• Can be expensive or time consuming, particularly for large infestations • An area to store the removed crown may be required • The treatment area has the same restrictions as those for herbicide treatment
Biosecurity Zone Option 1 (multiple small zones)	Fencing is installed, including an appropriate buffer zone, to minimise total area excluded	• Reduces the quantity of INNS infested soils (Table 12). • Reduces the area required for bunding of INNS arisings.	• Does not mitigate the risk associated with unknown greater historic distribution masked by previous unknown herbicide treatment, with associated increased risk of accidental spread • Increases the number of washdowns required, with associated potential issues relating to delays and run-off or escape of other pollutants
Biosecurity Zone Option 2 (combined zones)	Fencing is installed around multiple stands, even when buffer zones don't overlap, to create larger exclusion zone	• Better mitigates the risk associated with unknown greater historic distribution masked by previous unknown herbicide treatment. • Reduces the number of washdowns required, with associated potential issues relating to delays and run-off or escape of other pollutants	• Increases the quantity of INNS infested soils • Increases the area required for bunding of INNS arising
Biosecurity Zone Option 3 (dynamic)	Start with Biosecurity Zone Option 1 and expand as required.	• Minimises the quantity of infested soils • Minimises the area required for bunding of INNS arisings	• Does not mitigate the risk associated with unknown greater historic distribution masked by previous unknown herbicide treatment, with associated increased risk of accidental spread • Increases the number of washdowns required, with associated potential issues relating to delays and run-off

			or escape of other pollutants
Bunding (local)	Move excavated material to an area of the Site in close proximity to the excavated area, where it can be treated with chemicals over a period of years, followed by re-used on Site.	• Very cost effective • No import of backfill required to reinstate the area after deconstruction • Infested arisings do not need to be transported over distance	• Proximity to water may necessitate special permission from the Environment Agency • Requires undisturbed area and further monitoring and treatment • Soil from stockpile must remain on Site • Restrictions remain in stockpile area
Bunding (elsewhere)	Move excavated material to an area of the away from the excavated area, where it can be treated with chemicals over a period of years, followed by re-used on Site.	• Cost effective • Infested arisings need to be transported over distance, with associated risk of accidental spread	• Requires undisturbed area and further monitoring and treatment • Soil from stockpile must remain on Site. • Restrictions relating to transporting such material via highways are in place (necessitating an exemption from the EA) • Restrictions remain in stockpile area • Soil import required to backfill void
Geotextile installation	Geotextiles can be used to create vertical and horizontal rhizome barriers	• Prevents regrowth from buried rhizome or encroachment from plants adjacent to Site. • Cost effective when compared to full excavation, especially for larger stands.	• Restrictions remain on Site. • Geotextiles can be damaged. • Installation can be time-consuming.
Soil stabilisation	Stabilisation of soils containing herbicide treated Japanese knotweed as a form of reuse	• Reduces waste creation. • Reduces the quantity of infested soil that needs to be transported. • The stabilisation process desiccates and heats the soil. Experiments have shown that knotweed rhizome becomes unviable following desiccation or when heated above 50 C for 4 hours.	• Removal of sufficient crown and rhizome material will be required to bring the organic content of soil down to required thresholds and/or other geotechnical limitations may apply (dependant on the characteristics of the soil). • Removed crown and rhizome must be handled appropriately. • The equipment used to auger/mix the soil will need to be thoroughly cleaned prior to use outside biosecurity zones.
Burial	Excavation of impacted soils and burying the material on Site. Japanese knotweed at 2m	• Does not require a set-aside area and ongoing control (regarding arisings)	• Expensive • Soil import required to backfill void • Limits use of area above

	(encapsulated) or 5 m (not encapsulated). Other INNS, typically 2 m.		burial site • Requires a large hole to receive material • Does not meet the stated aim of minimising waste creation
Disposal Off-Site	Excavation of impacted soils and removing the material to a landfill registered to receive such waste using covered haulage vehicles.	• No restrictions left on Site (regarding arisings)	• Very expensive • Soil import required to backfill void • Least environmentally sound option • Does not meet the stated aim of minimising waste creation

Appendix C – Herbicide Based Remediation of INNS

As per best practice, wherever possible, the amount of INNS excavated should be kept to a minimum and the focus should be treating the INNS in their original location and protecting engineered surfaces and structures from being damaged, with activities being carried out in a manner that causes minimal disturbance to the surrounding environment. Herbicide based treatment is typically the best option to achieve these goals and should be the first choice for INNS control where possible/practical.

Permission is required from Natural England and the Environment Agency for working within a SSSI and applying herbicide near water, respectively.

Contractor's method statements for herbicide-based works in INNS affected areas should ensure compliance with the protocols set out within this document and the Site-specific Biosecurity and Management Plan (BMP). Contractors involved in such works must liaise with the appointed INNS specialist (AECOM), who must validate that all Method Statements follow current best practice, include appropriate biosecurity protocols, and include mitigation for the risks posed by control action.

Any person involved in the application of herbicides must possess the appropriate pesticides certificate of competence for the safe use of herbicide and hand-held herbicide applicators, including near water, e.g. National Proficiency Tests Council (NPTC) Level 2 award in the safe use of pesticides PA1 and PA6(aw). The user is responsible for the risks that arise from use of herbicide products.

All appropriate information (i.e. name of operative, qualification of operative, site address, date of application, target species, reason for treatment, method of application, product used, application rate, quantity applied, total product used, any environmental risks identified, start time, finish time, weather conditions, and PPE worn) must be recorded following herbicide application in each area of INNS and these records retained in an approved manner within the recording system for the Site.

An approved systemic glyphosate-based herbicide must be used; specifically, Roundup ProVantage 480. The herbicide must be prepared and applied as directed on the product label. Roundup ProVantage is non-residual, i.e the herbicidal effect is lost on contact with the soil/sediment and the product is quickly broken down in soil or sediment into harmless natural substances. Roundup ProVantage does not leave any harmful residues in the soil and does not impact the waste classification of soil if disposal is required subsequently.

An Environmental Risk Assessment must be carried out prior to herbicide treatments, including potential impacts on bees. There should be no adverse environmental impact from the use of Roundup ProVantage, when used in accordance with the label and following best practice. In fact, as the product is being used to control listed INNS, there will be a significant positive environment impact associated with its use.

Herbicide application must only be carried out when plants are dry and when there is a high likelihood of no rain in the next six hours post application. Roundup ProVantage is rainfast in 4 hours for perennial plants in 1 hour for annual plants.

The following procedures must be employed to ensure drift, and impacts on non-target vegetation, is at the lowest possible level:

- herbicide must only be applied on windless / low wind days. Specifically, a light breeze at the height of the spray nozzle (Beaufort Force 2 - Leaves rustle and you can feel the wind on your face) or less;
- the coarsest appropriate spray quality (droplet size) must be used at all times;
- a highly directional nozzle that produces a large droplet size (e.g. Deflector Tip Green

DT0.75), further minimising drift, should be used; and

- while Roundup ProVantage is not absorbed through mature bark, so it is possible to spray right up to mature trees, the green bark of immature whips will absorb the herbicide and extra care must be taken to prevent drift in such cases.

Herbicide will be applied generously to both upper and lower surface of leaves and to the stems. Application to the lower surface of Japanese knotweed leaves is critical.

Appropriate Personal Protective Equipment (PPE) will be worn when handling concentrate and applying herbicide.

Where possible, it is important that plants are not disturbed for at least three weeks post herbicide application (ideally six). It is only after such a time that the plants will show the full effect of the herbicide, i.e. the effect is not immediate.

Stands in areas that will be excavated should be treated, once they have reached an appropriate condition, up to the point of removal. Where other site works are required in such areas prior to excavation (e.g. vegetation clearance), in addition to the biosecurity requirement detailed below, it is imperative that during the growth season plants are not damaged during such works or it will impact subsequent herbicide treatment (intact plants are required for effective herbicide treatment). Where such damage is likely to be unavoidable, herbicide treatment can take place earlier in the season (no less than 3 weeks, but ideally 6 weeks, in advance of disturbance); A wide range of options are available for the management of INNS (see below), all of which should be considered in identifying the most appropriate management regime relevant in the context of a given location. All options should be considered in the context of the risk and pathway analyses.

Appendix D – Biosecurity Implementation Record (BIR) – Example

Works carried out inside Biosecurity Zones

Project:		**Date:**	
Work Package:			
Description:			
Biosecurity Zone Ref:	[As per BMP (e.g. K6 or K10)]		
BIR Number:	[Number sequentially where multiple BIRs are required in a single Biosecurity Zone]		
Checks by (Print names and initial):	[Work team verifier]	[ECoW]	

Ref	**Description**	[Insert contractor] **Work team verification**		[Insert contractor] **Ecological Clerk of Works Verification**		**Remarks**
		Initial	**Date**	**Initial**	**Date**	
1	Toolbox talk delivered to site operatives by ECoW					
2	Biosecurity requirements, as per the Toolbox talk, BMP and RAMS are understood by the work gang, who have signed the Acceptance Sheet below.					
3	Invasive species demarcated					
5	Biosecurity wash down procedures / station in place (tick relevant): □ tub/bucket □ pick/brush □ hand pump spray □ machine spray □ arisings capture □ other (name):					
6	Biosecurity checks being made on entry to Biosecurity Zone (add details below for plant/equipment)					
7	Biosecurity checks being made on exit from Biosecurity Zone (add details below for plant/equipment)					
8*	If vegetation arisings are being removed – all have been checked and are confirmed free from INNS					
9**	If samples are being removed (e.g. soil samples) – it is confirmed that all are clearly labelled as containing INNS					

NOTES:

Page 1 (1 to 7) should be completed on the first day of a Work Package inside a given Biosecurity Zone

Page 1 (*8 and **9) should be completed at the end of a Work Package inside a given Biosecurity Zone

Page 2 should be updated throughout the implementation of the Work Package

If an action is not witnessed by the ECoW, it should be marked as not witnessed in the Remarks field.

Any adjustments to works methodology described in BMP/RAMS, should be detailed in Comments Section at the end of Page 2.

Plant/Equipment Records – to be updated daily and compiled weekly (send to relevant Environment Manager / QA)

Plant/Equipment reference	Entry/Exit (tick one and add time/date)	Soil/plant material attached	Soil/plant material removed	Remarks
	□ Entry Date: □ Exit Time:	□ Yes □ No	□ Yes □ No □ N/A	
	□ Entry Date: □ Exit Time:	□ Yes □ No	□ Yes □ No □ N/A	
	□ Entry Date: □ Exit Time:	□ Yes □ No	□ Yes □ No □ N/A	
	□ Entry Date: □ Exit Time:	□ Yes □ No	□ Yes □ No □ N/A	
	□ Entry Date: □ Exit Time:	□ Yes □ No	□ Yes □ No □ N/A	
	□ Entry Date: □ Exit Time:	□ Yes □ No	□ Yes □ No □ N/A	
	□ Entry Date: □ Exit Time:	□ Yes □ No	□ Yes □ No □ N/A	
	□ Entry Date: □ Exit Time:	□ Yes □ No	□ Yes □ No □ N/A	
	□ Entry Date: □ Exit Time:	□ Yes □ No	□ Yes □ No □ N/A	
	□ Entry Date: □ Exit Time:	□ Yes □ No	□ Yes □ No □ N/A	
	□ Entry Date: □ Exit Time:	□ Yes □ No	□ Yes □ No □ N/A	
	□ Entry Date: □ Exit Time:	□ Yes □ No	□ Yes □ No □ N/A	
	□ Entry Date: □ Exit Time:	□ Yes □ No	□ Yes □ No □ N/A	

Comments Section (include details of any change from the management plan):

ECoW – Ecologist Clerk of Works (Sign):

Acceptance Sheet (to be signed by all members of the work gang), denoting that the work team has been briefing on, and understand the content of, the RAMS and BMP.

Name (Print)	Company	Signature	Date

Additional Plant/Equipment records (use as required):

Plant/Equipment reference:	**Entry/Exit (tick one and add time/date)**	**Soil/plant material attached**	**Soil/plant material removed**	**Remarks**

	☐ Entry Date: ☐ Exit Time:	☐ Yes ☐ No	☐ Yes ☐ No ☐ N/A	
	☐ Entry Date: ☐ Exit Time:	☐ Yes ☐ No	☐ Yes ☐ No ☐ N/A	
	☐ Entry Date: ☐ Exit Time:	☐ Yes ☐ No	☐ Yes ☐ No ☐ N/A	
	☐ Entry Date: ☐ Exit Time:	☐ Yes ☐ No	☐ Yes ☐ No ☐ N/A	
	☐ Entry Date: ☐ Exit Time:	☐ Yes ☐ No	☐ Yes ☐ No ☐ N/A	
	☐ Entry Date: ☐ Exit Time:	☐ Yes ☐ No	☐ Yes ☐ No ☐ N/A	
	☐ Entry Date: ☐ Exit Time:	☐ Yes ☐ No	☐ Yes ☐ No ☐ N/A	
	☐ Entry Date: ☐ Exit Time:	☐ Yes ☐ No	☐ Yes ☐ No ☐ N/A	
	☐ Entry Date: ☐ Exit Time:	☐ Yes ☐ No	☐ Yes ☐ No ☐ N/A	
	☐ Entry Date: ☐ Exit Time:	☐ Yes ☐ No	☐ Yes ☐ No ☐ N/A	
	☐ Entry Date: ☐ Exit Time:	☐ Yes ☐ No	☐ Yes ☐ No ☐ N/A	
	☐ Entry Date: ☐ Exit Time:	☐ Yes ☐ No	☐ Yes ☐ No ☐ N/A	
	☐ Entry Date: ☐ Exit Time:	☐ Yes ☐ No	☐ Yes ☐ No ☐ N/A	
	☐ Entry Date: ☐ Exit Time:	☐ Yes ☐ No	☐ Yes ☐ No ☐ N/A	
	☐ Entry Date: ☐ Exit Time:	☐ Yes ☐ No	☐ Yes ☐ No ☐ N/A	
	☐ Entry Date: ☐ Exit Time:	☐ Yes ☐ No	☐ Yes ☐ No ☐ N/A	
	☐ Entry Date: ☐ Exit Time:	☐ Yes ☐ No	☐ Yes ☐ No ☐ N/A	

Cleaning Vehicles & Items of Plant

A log with each wash down recorded. These records will be collated on a weekly basis and shared with client.

When cleaning a vehicle or item of plant the driver/operator must ensure they are positioned on the wheelwash. A thorough clean of the vehicle/item of plant will be carried out using the hard bristle brush, ensuring that all visible soil/mud is brushed off before using the pressure washer. This extended brushing minimizes the volume of water used for each so Drivers/Operators must ensure the brushing of the vehicle or item of plant is given priority to clean the vehicle with the pressure washer, then used to clean areas of the vehicle/item of plant that cannot be reached with a hard bristle brush.

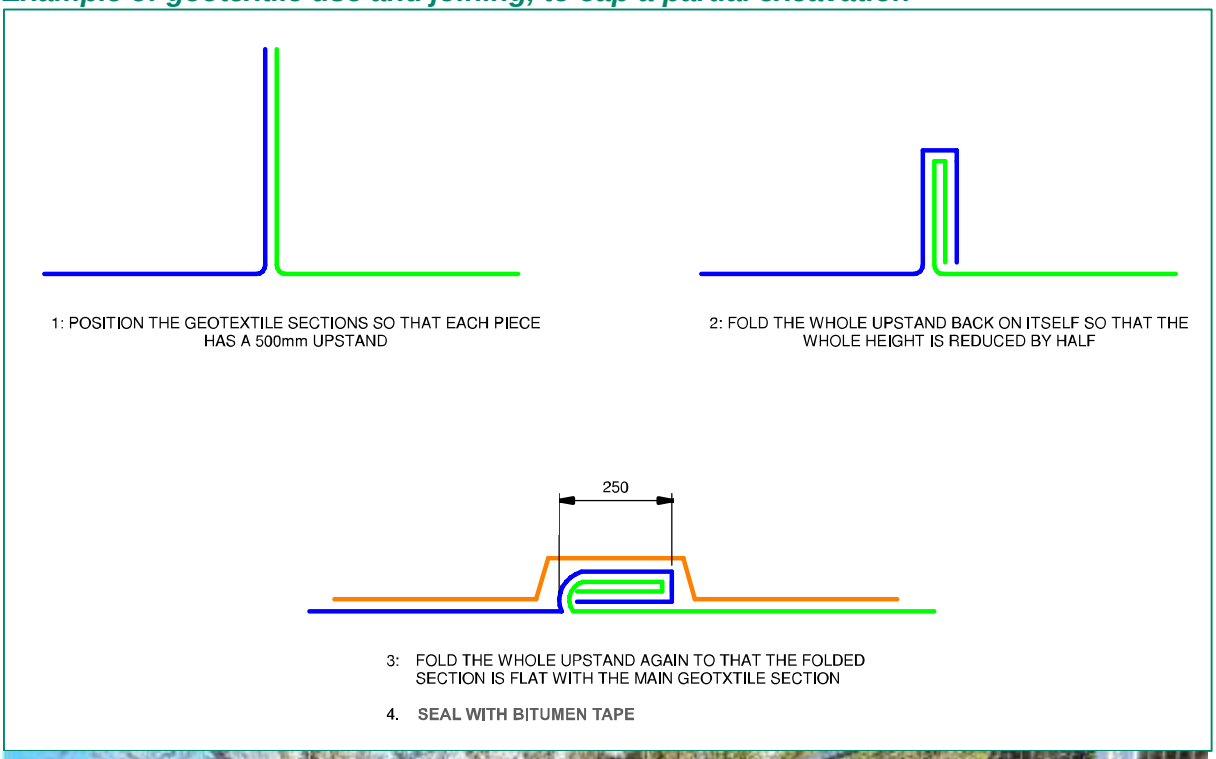
Appendix E – Biosecurity Examples

Example of signage that should be used to demarcate the presence of Japanese knotweed within a biosecurity zone

Example of a plywood sheet being used to prevent contact with infested soils

Examples of polyethene/ply sheet being used to contain biosecurity arisings

Example of geotextile use and joining, to cap a partial excavation



Example of soil protection underlain by Terram, to create access through an infested area

Example of biosecurity fencing adjacent to soil protection (track matting with polythene underlay) polythene collar created by fixing polythene to Herras, for extra protection

Example of boot wash, simple and complex


BOOT WASH
CROSS
PLANT HIRE