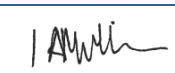
West Cumbria Rivers Trust

Caring for our Lakes and Rivers

Derwent Catchment Invasive Non-native Species Strategy and Action Plan 2023-2027

Author:	Izzie Mullin – Project Officer – Invasive Species	
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Contents

1 Executive Summary

1.1.1 This five-year strategy for the Derwent catchment outlines a coordinated, strategic, standardised approach for the management, prevention and surveillance, detection and monitoring of specified invasive non-native species (INNS). The strategy addresses the whole catchment, with emphasis on preserving waterbodies, riparian zones and preventing the establishment of new INNS into the catchment.

1.1.2 The aim of the Derwent Catchment Strategy is:

To develop and maintain cost-effective sustainable strategic approaches to prevent, detect, control and eradicate specified invasive non-native species in the Derwent catchment through a uniform, catchment-based approach across partners.

Particular emphasis will be put on protecting 'pristine' areas, preventing the arrival of high-impact species and coordinated, joined-up management of INNS already present in the catchment. This Derwent catchment strategy has four objectives; the first will establish the current state of INNS in the catchment whilst the remaining three are centred on the key national management goals of prevention, surveillance, early detection, monitoring, rapid response and long-term management.

Objective 1: Produce a plan to establish the base level of INNS across the Derwent catchment in 2023

Objective 2: Develop a management strategy for current INNS present in the catchment

Objective 3: Develop a strategy to reduce the risk of new INNS being introduced to the catchment

Objective 4: Develop a sustainable identification and reporting methodology, which can be used long-term and benefits multiple organisations

1.1.3 Currently, there is only limited partner coordination when it comes to INNS management and prevention. This strategy sets out the framework to improve this to create a catchment-based approach through developing communication channels and outlining standardised management methods.

1.1.4 The actions and approaches set out in this strategy are purposefully broad. This allows for applicability on a catchment-wide scale, but also on a smaller scale to specific National Trust properties. Whilst a catchment-based approach is the preferred option of this strategy, we acknowledge that this is not always feasible due to the associated costs and some parts of this strategy can therefore be applied to certain areas of the catchment, based upon funding restrictions.

1.1.5 Whilst this is the first strategy of its kind for the Derwent catchment, there are past strategies and frameworks that address INNS on a national and regional level. These frameworks and strategies, including the recently published 2023 GB Strategy and the 2018 Northern Regional Invasive Species Management Plan, are written to be applied on larger scales yet they also provide the frameworks and mechanisms to assist in writing local strategies. Analysis of these strategies revealed the need for this one and helped to define what an INNS is in the context of the Derwent catchment.

1.1.6 The base-level status of INNS across the Derwent catchment is not currently known and there has been disjointed mapping across partners over the years, with partners unable to share mapping records leading to significant disparities in knowledge. A story-map hosted by West

Cumbria Rivers Trust has been created and all past INNS records have been amalgamated into this map. A new standardised survey has been created by WCRT and can be accessed by all partners. A similar public survey has also been created, allowing volunteers and members of the public to be able to report INNS sightings to WCRT, including INNS already in the catchment and INNS new to the catchment. Both surveys will contribute to understanding the catchment-wide status of INNS when taken into consideration alongside proposed base-level surveys, to be carried out across 2023-24, including lake surveys.

1.1.7 Whilst there has been some management of INNS by partners across the catchment it has been dependent on funding and not all partners have used the same methods. This strategy outlines proposed methods for the control and management of all INNS present in the Derwent catchment, regardless of whether there is any active control. This aims to provide all partners with the best tools at their disposal should funding become available, so that management can begin quickly and correspond with what partners may be doing. It also allows for a more catchment-based approach, as it facilitates partners to coordinate treatment.

1.1.8 Whilst management of INNS currently present in the catchment is important, it is imperative that we prevent any other INNS from entering the catchment and becoming established through ensuring biosecurity is in place across the catchment. Pathways through which INNS could enter the catchment have been risk assessed to determine which to focus on, showing that general freshwater recreational activities present the highest risk due to the high numbers of visitors. Biosecurity in the catchment will be improved through taking part in the AQUA accreditation scheme, updating and installing signage at access points and improving campaigning through social media, event attendance and access to materials. It will also include developing washdown stations (including a portable washdown station) and continuing to explore the potential of installing one on Derwentwater. These biosecurity measures should help to reduce the risk of INNS being introduced to the catchment, however, should a new INNS be introduced, a swift identification, reporting and management mechanism is required.

1.1.9 A new, comprehensive mapping and reporting system will allow any new INNS to be identified early and swiftly. Through offering training to interest groups and partners, surveillance across the catchment will be improved to ensure that individuals who are frequently on the ground are capable of identifying new INNS and know the correct protocols for reporting this. Response protocols for the most likely introduced INNS have been outlined to allow for swift management.

Table 1 The Action Plan for the Derwent Catchment Strategy. A solid line indicates continuous implementation whilst a broken line indicated implementation as required.

Action	Lead	Input required from	Time Frame				
			2023	2024	2025	2026	2027
Objective 1- to determine the base level of INNS across the catchment							
Output 1.1 – develop a cohesive, cross-organisation open-access mapping system							
Collect current INNS mapping records from across partners	WCRT	NT	—				
Create a public Storymap which all partners and members of the public can access	WCRT	NT	—				
Input all current mapping data into the public system	WCRT	ALL	—				
Output 1.2 ensure longevity of mapping system							
Create a partners' reporting form for INNS sightings	WCRT		—				
Create a public reporting system for new INNS, with inbuilt alert system	WCRT		—				
Output 1.3 carry out base level surveys for INNS across the Derwent catchment							
Winter lake surveys	NT		—				
Summer lake surveys	NT		—				
Base level river surveys	NT		—	—	—		
Objective 2 – Develop a management plan for current INNS present in the catchment							
Output 2.1 develop realistic INNS management plans for each INNS currently present in the catchment, for utilisation when organisations have the resources (time frame specified is the optimal time frame for strategy deployment)							
Japanese Knotweed management plan	WCRT		—	—	—	—	—
American Skunk Cabbage management plan	WCRT		—	—	—	—	—
Giant hogweed management plan	WCRT		···	···	···	···	···
Montbretia management plan	WCRT		···	···	···	···	···
Canadian/Nuttall's pondweed management plan	WCRT		···	···	···	···	···
Mink management plan	WCRT		···	···	···	···	···
Rhododendron management plan	WCRT		—	—	—	—	—
Geese management plan	WCRT	NT	—	—	—	—	—
Grey Squirrel management plan	WCRT	NT	—	—	—	—	—
Output 2.2 develop a Himalayan balsam management plan, to include both management using volunteers and biocontrols							
Promotion of Himalayan balsam community groups and guerrilla balsam bashing	WCRT		—	—	—	—	—
Himalayan balsam rust fungus site scoping and seed collection	WCRT & NT		—				
Himalayan balsam rust fungus release				—	—		
Rust fungus monitoring	WCRT			—	—	—	—
Output 2.3 develop a New Zealand pygmyweed management plan for Derwentwater							
Winter lake mapping surveys	NT	WCRT	—				
Summer lake mapping surveys	NT	WCRT	—				
Crassula mite biocontrol scoping	NT	WCRT	···	···	···	···	···
Biosecurity sign installation at access points	NT	WCRT	—				
Output 2.4 develop a New Zealand pygmyweed management plan for Crummock Water							
Winter lake mapping survey	NT	WCRT	—				
Press release announcing presence in Crummock Water	NT	WCRT	—				

Action	Lead	Input required from	Time Frame				
			2023	2024	2025	2026	2027
Summer lake mapping survey	NT	WCRT					
WCF installation phase 1	NT	WCRT					
WCF installation phase 2	NT	WCRT					
WCF removal phase 1	NT	WCRT					
Second round of treatment	NT	WCRT					
Continual New-Zealand pygmyweed monitoring	NT	WCRT					
Output 2.5 A New Zealand pygmyweed management plan for other lakes							
Objective 3 – Develop a strategy to reduce the risk of new INNS being introduced into the catchment							
Output 3.1 – complete risk assessments for all pathways and mitigation methods							
Output 3.2 Update signage							
Install signage on access points at Derwentwater	NT						
Install signage at access points on Crummock Water	NT						
Install signage at access points on Buttermere	NT						
Install signage at access points on Loweswater	NT						
Install signage at access points on Bassenthwaite Lake	LDNPA						
Output 3.3 Develop a hub for biosecurity materials							
Update biosecurity materials	WCRT						
Maintain a store of materials	WCRT						
Advertise the material store	WCRT	ALL					
Output 3.4 Increase biosecurity education through a check, clean, dry campaign							
Attend events listed in the strategy	ALL						
Increase social media messaging and press releases	ALL						
Develop a biosecurity education programme	WCRT						
Purchase portable washdown stations	WCRT /NT						
Visit key access points with washdown station in peak season	WCRT /NT						
Encourage lending out of the station at washdown events	ALL						
Install a permanent washdown station on Derwentwater	NT						
Output 3.5 increase education of INNS							
Rangers, project officers and outdoor workers to complete NNSS e-learning modules 1-3a	ALL						
Training programme developed for groups	WCRT						
Training programme offered to and delivered to interest groups	WCRT						
Output 3.6 partake in AQUA accreditation scheme							
Identify potential biosecurity guardians for Derwentwater	ALL						
Begin bronze award for Derwentwater	NT						
Silver award for Derwentwater	NT						
Identify potential for biosecurity guardians for Crummock Water and Buttermere	NT						
Begin Bronze award for Crummock Water and Buttermere	NT						
Objective 4 – Develop a sustainable identification and reporting methodology which can be used long-term and benefits multiple organisations							

Action	Lead	Input required from	Time Frame				
			2023	2024	2025	2026	2027
Output 4.1 develop a cross-organisational methodology for identifying non-GB species							
Define the data flow for INNS identification and reporting to national/regional teams	WCRT		▪▪▪▪▪▪▪▪	▪▪▪▪▪▪▪▪	▪▪▪▪▪▪▪▪	▪▪▪▪▪▪▪▪	▪▪▪▪▪▪▪▪
Establish a cross-organisational reporting mechanism	WCRT		▪▪▪▪▪▪▪▪	▪▪▪▪▪▪▪▪	▪▪▪▪▪▪▪▪	▪▪▪▪▪▪▪▪	▪▪▪▪▪▪▪▪
Establish a public reporting mechanism and maintain it	WCRT		▪▪▪▪▪▪▪▪	▪▪▪▪▪▪▪▪	▪▪▪▪▪▪▪▪	▪▪▪▪▪▪▪▪	▪▪▪▪▪▪▪▪
Output 4.2 develop rapid response protocols for each species of concern							
Define which species requires a national response	WCRT		▬▬▬				
Define which species requires a local response	WCRT		▬▬▬				

2 Summary of Abbreviations

ASC	American skunk cabbage
CABI	Centre for Agriculture and Bioscience International
CCD	Check, clean, dry
DIP	Derwent Invasives Partnership
EA	Environment Agency
GBNNSS	Great British Non-Native Species Secretariat
GH	Giant Hogweed
HB	Himalayan balsam
INNS	Invasive non-native species
JK	Japanese Knotweed
LAG	Local Action Group
LDNPA	Lake District National Park Authorities
NE	Natural England
NT	National Trust
PAP	Pathway action plan
RAPID	Reducing and Preventing Invasive Alien Species Dispersal
RIMP	Regional Invasives Species Management Plan
UNESCO	United Nations Educational, Scientific and Cultural Organisation
SAC	Special Area of Conservation
SSSI	Site of Special Scientific Interest
LDNP	Lake District National Park
NNSIP	Non-native Species information Portal
NT	National Trust
WCF	Weed Control Fabric
WCRT	West Cumbria Rivers Trust

3 Introduction

3.1 The need for a Derwent Catchment INNS Strategy

The number of INNS in GB continues to rise, with 3248 non-native species present, of which approximately 15% cause significant adverse impacts (JNCC, 2021). INNS threaten to reduce biodiversity, spread disease, modify ecosystems, drastically reduce and alternative populations across GB if left unchecked, unmanaged and uncontrolled (JNCC, 2021). The number of INNS in the UK will increase with climate change bringing about an elevated risk due to warmer winters, increased flooding and altered species ranges which will bring greater pressure on GB freshwater systems, including the Derwent catchment (Berry, Brown, 2021; JNCC, 2021). The 679km^2 Derwent catchment includes multiple SACs and SSSIs and 64% of the catchment falls within the LDNP, a UNESCO World Heritage Site that attracts 17 million visitors a year, putting it at greater risk of introduced species from elsewhere in GB and across the world. Therefore, there is a need for an INNS strategy for the Derwent catchment that outlines a standardised management, prevention and surveillance, detection and monitoring strategy for use across partners within the catchment.

3.2 Invasive non-native species in the context of the Derwent catchment

There are various different ways to define INNS, with the Great British Non-Native Species Secretariat defining them as “species whose introduction and/or spread threaten biological diversity or have other unforeseen impacts” (GBNNSS, 2023). The number of NNS GB is threatened by is extensive, with a full list available on the NNSIP, with detailed information available including control methods for 300 INNS (GBNNSS, 2022). This is an extensive list and not all of these species pose a threat to the Derwent catchment. INNS have been defined and responses outlined before in previous international, national and local policy and planning frameworks. National and regional polices and plans have focused on defining INNS that require prevention and rapid response. Local, organisation-based plans have focused on defining INNS already present, which need control and/or removal. None of these plans has focused on a Derwent catchment-based approach to INNS that may be present, or INNS that could be entering the catchment. As such, it will contribute to and be supported by the various available national and regional plans but be tailored to the entire Derwent catchment.

3.3 Current state of INNS management in the Derwent Catchment

The Derwent catchment is unique in that it is situated in a National Park and contains multiple SACs and SSSIs, so is therefore managed by numerous partners including the LDNPA, NT, WCRT, EA and NE. In the past, INNS management has been coordinated across these partners; however, with reduced funding and resources these INNS communication pathways and management efforts have been reduced in recent years, something we hope to rectify with this strategy and the development of the Derwent Invasives Partnership (DIP). The Derwent catchment comprises various tributaries including the Glenderamackin, the Greta, St Johns Beck and Thirlmere, Upper Derwent and Derwentwater, Middle Derwent and Bassenthwaite, the Cocker and Buttermere, Crummock Water and Loweswater, the Marron and Lower Derwent (see figure 1). Across these sub-catchments, there is a variety of partners working on control. This includes management of INNS already in the catchment with the NT managing INNS on their land and WCRT working to control HB, JK and ASC across the catchment. Pathway management and biosecurity awareness occurs to some extent by NT, LDNPA, NE and WCRT with the use of permits on usage of certain lakes, implementing event biosecurity measures and signage at access points. The large proportion of the Derwent catchment being

situated within the National Park makes it highly vulnerable to freshwater INNS being brought in by water users on equipment such as wetsuits, SUPs, kayaks and canoes. The dis-jointed approach of partners in recent years and the increasing threat of climate change confirms the need for this strategy.

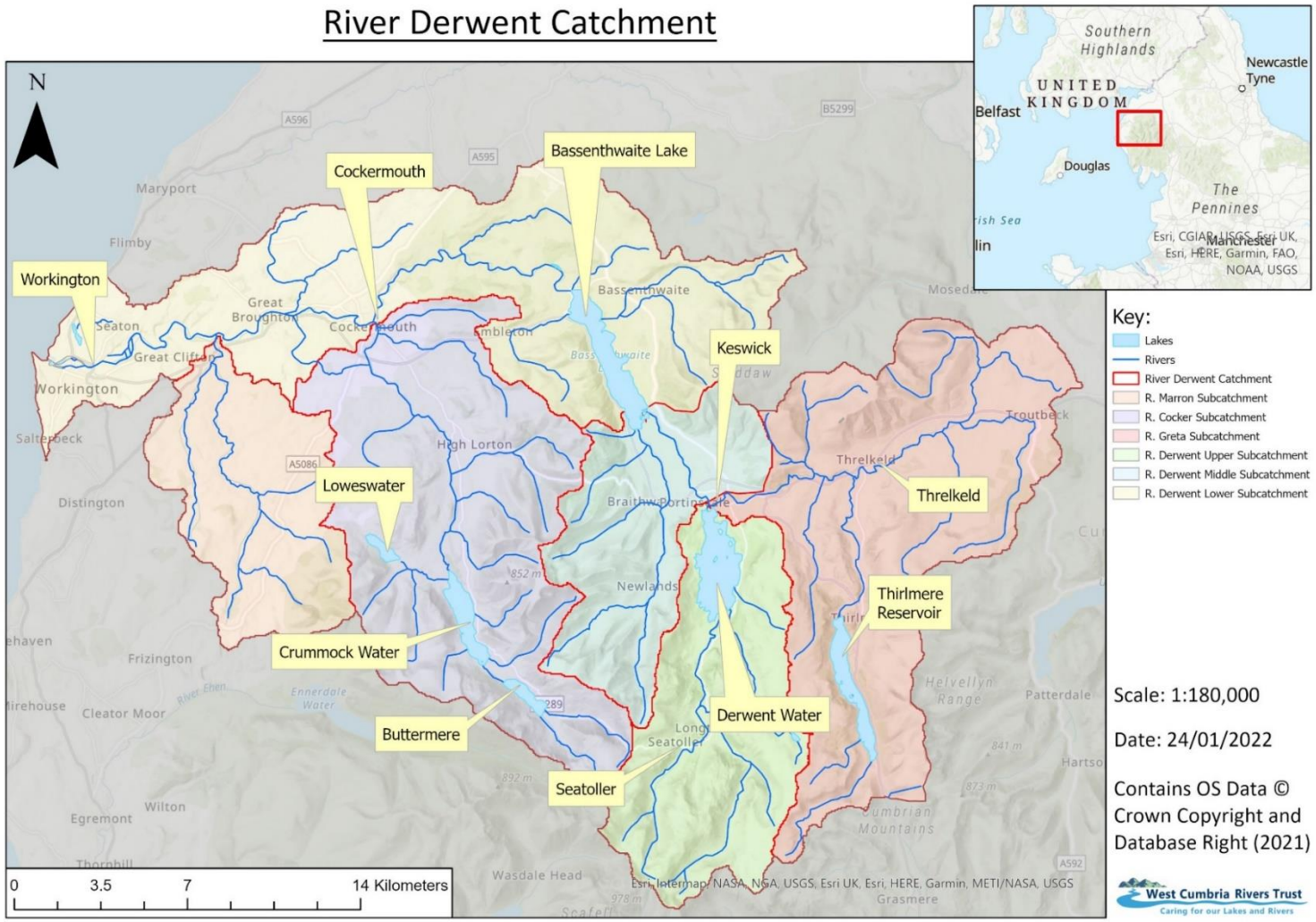

Figure 1 *Map of the Derwent catchment, showing the sub-catchments, major watercourses and settlements.*
Basemaps Data Sources: Esri, USGS, NGA, NASA, CGIAR, Ordnance Survey, Intermap, Esri UK, HERE, Garmin, METI/ NASA, FAO, NOAA.
Catchment and subcatchment outlines: © Environment Agency copyright and/or database right 2015
Rivers layer: Uncredited in metadata, but likely contains Ordnance Survey data ©.
Lakes layer: © Environment Agency copyright and/or database right 2015. Contains Ordnance Survey data © Crown copyright and database right 2013.

3.4 Aims and Objectives

The aim of the Derwent Catchment Strategy is:

To develop and maintain cost-effective sustainable strategic approaches to prevent, detect, control and eradicate specified invasive non-native species in the Derwent catchment through a uniform, catchment-based approach across partners.

Particular emphasis will be put on protecting 'pristine' areas, preventing the arrival of high-impact species and coordinated, joined-up management of INNS already present in the catchment. This Derwent catchment strategy has four objectives; the first will establish the current state of INNS in the catchment whilst the remaining three are centred on the key national management goals of prevention, surveillance, early detection, monitoring, rapid response and long-term management.

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4 Current INNS legislation and INNS within the context of the Derwent catchment

4.1 Current INNS legislation

4.1.1 The threat of INNS has been addressed on international, national, regional and local levels, with legislation also developed on both an international and national level. The Convention on Biological Diversity is a major driver for national INNS strategies, driven primarily by the EU Invasives Species Regulation. Despite the UK no longer being an EU Member State, many of the measures implemented in this regulation have been transferred into GB legislation and national plans. The aims and outputs of these plans must be understood to know where this strategy sits within previous framework.

4.1.2 The key national policy to consider is the GB INNS Strategy, first published in 2008 and revised in 2015 and 2023. The GB Strategy puts an emphasis on preventing INNS from entering the country, as well as sets out key actions needed to achieve its aims by 2030:

- To prevent the establishment of INNS within the country (reducing 2000 establishment levels by 50%).
- Improve national detection and monitoring capabilities.
- Manage any INNS through eradication or control which are of high priority due to their impact and the likelihood of the success of removal.
- Prioritise species and carry out risk analysis to set out where efforts should be focused to achieve the greatest benefit.
- Increase awareness of INNS across GB and promote the appropriate changes in attitude that should be carried out.
- Improve coordination across government, government bodies and LAGs when it comes to INNS.

4.1.3 The national strategy focuses on widespread INNS control and raising awareness across Great Britain, leaving the need for a more tailored plan. The RAPID North RIMP was published in 2018, with the aim to link the national strategy to local action groups and provide the tools for this through:

- Setting out a risk assessment mechanism for evaluating sites and their vulnerabilities.
- Providing recommended actions for reducing the risk of INNS introduction on the main freshwater pathways.
- Listing freshwater INNS and their management priorities across the North.
- Defining the key elements that should be factored into response protocols for North alert species.
- Suggesting objectives and outputs for a catchment based/local report.

4.1.4 Before the North RIMP was published, there were local action plans developed such as the Cumbria High Impact Freshwater Invasive Species Action Plan (2015) and two WCRT INNS reports (2021, 2019). The Cumbria wide plan defines which species should have a priority response, a response at selected areas or be contained to slow the spread. The two local WCRT plans outline what management is being undertaken on INNS already present in WCRT catchments. The Derwent catchment strategy will incorporate these local plans whilst building on the strategic actions and tools detailed in the RIMP and applying the GB government legislative frameworks set out below:

- Section 14 of the Wildlife and Countryside Act (1981) makes it an offence for any animal which is not a GB resident or is listed under Schedule 9 of the 1981 Act, to be released/allowed to escape from captivity. It is also an offence to allow any plant listed under Schedule 9 to grow, cause to grow or spread.
- The Environmental Protection Act 1990, The Waste Management Licensing Regulations 1994, The Controlled Waste Regulations 1991 and the Environmental Protection Regulations 1991 all outline in various ways the correct handling of controlled waste, including waste containing INNS. These acts and regulations specify that handling of waste must not endanger human health, environmental health or be done without a license.
- The Keeping and Introduction of Fish Regulations 2015 gives the Environment Agency the power to regulate fish movements.

4.2 Definition of INNS

The first stage in developing this strategy was defining and identifying INNS for the Derwent catchment. Based upon past national and regional strategies as well as legislation there are various ways to define an INNS. The North RIMP INNS list encompasses species on Schedule 9 where Schedule 14 applies, GB Alert Species and species that are of EU concern. However, since its publication, there have been updates made to the GB alert species list and the EU list of Concern. Additionally, the traffic light system employed in the RIMP applies to the whole North, not just the Derwent catchment so there are significant lapses where some species that should be higher rated as priority species due to their presence elsewhere in the North. Additionally, there are INNS present in some Derwent sub-catchments, which are not present across the whole catchment and there is great potential for restricting the spread of these species to other areas of the catchment through comprehensive biosecurity measures. Therefore, the traffic light system has been tailored to both address the risk of INNS introduction from outside the catchment and the risk of introduction to other sensitive areas within the catchment. INNS within the Derwent catchment are outlined in **Table 2** whilst the traffic light system is outlined and compared to the RIMP system in appendix 1.

Table 2 List of INNS of concern in the Derwent catchment; including both their common name and Latin name. Colour coding corresponds to their Derwent catchment risk rating, outlined in appendix 1.

Species	Derwent rating
Killer shrimp *Dikerogammarus villosus*	
Demon shrimp *Dikerogammarus haemobaphes*	
Bloody red shrimp *Hemimysis anomala*	
Topmouth gudgeon *Pseudorasbora parva*	
Floating pennywort *Hydrocotyle ranunculoides*	
Curly waterweed/curly water-thyme *Lagarosiphon major*	
Asian Hornet *Vespa velutina*	
Quagga Mussel *Dreissena rostriformis bugensis*	
Zebra mussel *Dreissena polymorpha*	
Chinese mitten crab *Eriocheir sinensis*	
Water primrose *Ludwiga grandiflora*	
Water fern *Azolla filiculoides*	
Purple pitcherplant *Sarracenia purpurea*	
Giant knotweed *Fallopia sachalinensis*	
Hybrid knotweed *Fallopia x bohemica*	
Himalayan knotweed *Persicaria wallichii*	
African sacred ibis *Threskiornis aethiopicus*	
New Zealand pygmyweed/Australian swamp stonecrop *Crassula helmsii*	
Canadian waterweed *Elodea canadensis*	
Nuttall's waterweed *Elodea nuttallii*	
Parrot's feather *Myriophyllum aquaticum*	
Grey squirrel *Sciurus carolinensis*	
Zander *Sander lucioperca*	
Black bullhead *Ameiurus melas*	
Creeping water-primrose *Ludwigia peploides*	
Fanwort *Cabomba caroliniana*	
Broadleaf watermilfoil *Myriophyllum heterophyllum*	

Species	Derwent rating
Water hyacinth *Eichhornia crassipes*	
American needle-grass *Nassella neesiana*	
Wireweed Sargassum muticum	
Wakame/Japanese kelp *Undaria pinnatifida*	
American bullfrog *Lithobates catesbeianus*	
Racoon *Procyon lator*	
Racoon dog *Nyctereutes procyonides*	
Tree groundsel *Baccharis halimifolia*	
Ruddy duck *Oxyura jamaicensis*	
Himalayan balsam *impatiens glandulifera*	
Japanese knotweed *fallopia japonica*	
Giant Hogweed *Heracleum mantegazzianum*	
American mink *Neovison vison*	
American Skunk Cabbage *Lysichiton americanus*	
Giant Rhubarb *Gunnera* - various	
Barnacle Goose *Branta leucopsis*	
American Signal Crayfish *Pacifastacus leniusculus*	
Marbled crayfish *Procambarus marmorkrebs*	
Spiny-cheek crayfish *Orconectes limosis*	
Virile crayfish *Orconectes virilis*	
Red swamp crayfish *Procambarus clarkii*	
Slipper limpet *Crepidula fornicata*	
Rhododendron *Rhododendron ponticum*	
Montbretia *Crocosmia x crocosmiflora*	
Ruffe *Gymnocephaluus cernuus*	
Canada Goose *Branta Canadensis*	
Greylag Goose *Anser*	

5 Objective 1: Produce a plan to establish the base level of INNS across the Derwent catchment in 2023

5.1 Determining the base level of INNS across the Derwent catchment

5.1.1 Current INNS work across the Derwent catchment is carried out with limited coordination between partners due to a lack of catchment wide planning, unsustainable funding and differing motivations for tackling INNS. Determining the base-level INNS status of the Derwent catchment would facilitate a more systematic cost-effective management plan. Ideally, using the base-level surveys partners would work together to apply a catchment-based approach to INNS management, working to eradicate INNS from the source down and to control INNS hotspots. This approach can only be enacted when we have a comprehensive view of INNS on all watercourses, which will be achieved through:

- Organising all current mapping materials from all partners
- Carrying out a full Derwent catchment walkover in 2023-24

5.1.2 To achieve the above, a mapping strategy has been developed which aims to:

- Be easily accessed by all partners. Not all partners use the same software so sharing a mapping system that can be edited by all is unrealistic. A structure has been developed to allow WCRT to host the map but also absorb data from other organisations using a standardised methodology.
- Be robust and withstand the test of time. Funding shortages are inevitable and so the system should be robust enough to be maintained with minimal resources and still be relevant in ten years' time.
- Be resource efficient. The map will be hosted by one person and so therefore management needs to be efficient.
- It should be easily transferable to national systems, such as INNS Mapper and easily accessed by external parties.

5.2 Combining current mapping records and developing a new system

5.2.1 To be able to develop a survey methodology for mapping the Derwent catchment the current status of INNS mapping should be established through merging current data from across partners into the new DIP map. In some areas mapping is up to date, however in some areas mapping is 10+ years old.

5.2.2 The aim is to update all mapping as of 2023/24 and to use this as the base from which we measure. However, funding for walkovers is tricky to procure thus an interim system has been established. Once base-level surveys have been completed there should be no need for periodic updating as the outputs of objective 3 should lead to partners being able to easily report new sightings and treatment records to the DIP mapping system.

5.2.3 The map will be hosted online at https://arcg.is/1WXfi0 and is monitored by WCRT but accessible to the public. Currently, past INNS records have been uploaded to the system, with the aim that these be replaced in time with base-level surveys. New records (including base-level surveys) will be able to be uploaded directly to the map using the standardised Fieldmaps survey by all partners.

5.3 Base level surveys/partners and public reporting system

5.3.1 Base level surveys will be carried out by NT using Fieldmaps and the standardised form developed by WCRT (appendix 2). Using the same survey across organisations will allow for uniformity of records. This form is available to all partners through the map linked above, with all records directly uploaded to the Derwent Invasives map. Using Fieldmaps allows for a breadth of information to be collected all at once. Fieldmap uploads will alert the WCRT project officer when a record has been uploaded and there is an option for surveyors to both add a photo and state their confidence level so records can be verified if need be. Using Fieldmaps and uploading them to the mapping system in this way will allow for longevity as the same system can be used in the future for new sightings, as well as being easily used alongside other mapping exercises. Fieldmaps is only accessible to those with an Arc license, hence the need for an alternative reporting mechanism for public reports which will require verification.

5.3.2 Using Fieldmaps allows recorders to upload both polygons (for plants) and points (for animals), whereas Survey123 (a platform similar to Fieldmaps) only allows for point based records. Members of the public without an Arc license will still be able to upload INNS records to the map using the Survey123 form also created as part of this strategy. When a public survey has been completed the Project Officer will be alerted and can then verify the record and alter the data format if required. Adding this extra layer of authentication to the mapping system will allow for an extra-added layer of certainty and allow all the mapping to be fully trusted. Where possible, all base-level surveys should be carried out using the Fieldmaps form to ease admin pressures.

5.3.3 Both surveys allow the surveyor to record the following information:

- INNS
- Surveyor name
- Organisation they belong to
- Contact details (where appropriate)
- Location
- Date
- Extent/area
- Density/number (where appropriate)
- Confidence level (where appropriate)
- Photo (where appropriate)

5.4 Mapping plan

5.4.1 Base level surveys would ideally be carried out August-September when vegetation is beginning to die back, but all INNS are large enough to be easily identified. Mapping should prioritise watercourses, as they are a High Priority area due to the speed and ease with which INNS can spread from them. As part of this, Derwentwater and Crummock Water will be mapped from the water by boat in both winter and summer 2023 by a team of NT and WCRT staff. These surveys will provide some understanding of the extent of INNS across the seasons which will support management decisions and better inform action plans. Ideally, Buttermere will be added to the summer survey list, to monitor the INNS status in the last known “pristine” lake. Ideally, if funding allows all watercourses need to be walked over from beck to beach with all waterbodies ideally surveyed around the margins for floating/submerged INNS. However, it is unrealistic to expect this to happen and therefore;

Fieldmaps will allow field agents to input INNS observations alongside their day-to-day walkovers.

5.4.2 Once all watercourses have been walked management for present INNS can be prioritised by area and a cross organisation attack plan formulated to allow for the optimal action in the most cost effective way. It is likely that walkovers will take several years to complete, so in the meantime management plans will have an element of adaptability as well as long-term eradication/control aims.

5.5 Recording treatment

5.5.1 A limitation of the DIP mapping system is that it does not have a mechanism for recording treatment and allowing partners to share this information. The most recent incarnation of INNS Mapper does however have a mechanism for recording and observing treatment, which partners should be encouraged to use. This mechanism also allows recorders to input their details and the organisation they belong to, which allows the records to be treated with a higher level of confidence.

5.5.2 The decision has been made that INNS Mapper will not be used for recording INNS records for the time being, as records are not attached to an individual, therefore lowering our confidence level.

6 Objective 2: Develop a management strategy for current INNS present in the catchment

6.1.1 INNS currently present in the catchment, as documented in Table 3 and https://arcg.is/1WXfi0 should be controlled and eradicated where time and funding allows in the most appropriate and cost-effective way. As already stated, prevention is of primary importance, however, left unchecked and uncontrolled INNS such as New Zealand Pygyweed and Himalayan balsam have the potential to dominate waterways and significantly affect the environmental, economic and social value of the catchment. Management plans have been written with the full knowledge that The NT will prioritise their land but acknowledge that a catchment-based approach will enact the most change.

6.1.2 It is not realistic to expect organisations to be able to invest significant amounts of resources into eradicating all INNS, so proposed management plans have been written with the following in mind:

- Management should be cost-effective, using volunteers where appropriate and use cost effective methods, including biocontrols where appropriate, as some INNS are past eradication.
- Management should be time-efficient.
- Management should begin at the source and work down, or equally at a hotspot such as a lake.
- It should consider the longevity of the project and be robust against potential funding and staffing changes.

Table 3 INNS present in the catchment

Species	Derwent rating
New Zealand pygmyweed/Australian swamp stonecrop *Crassula helmsii*	
Canadian waterweed *Elodea canadensis*	
Nuttall's waterweed *Elodea nuttallii*	
Grey squirrel *Sciurus carolinensis*	
Himalayan balsam *Impatiens glandulifera*	
Japanese knotweed *Fallopia japonica*	
Giant Hogweed *Heracleum mantegazzianum*	
American mink *Neovison vison*	
American Skunk Cabbage *Lysichiton americanus*	
Barnacle Goose *Branta leucopsis*	
American Signal Crayfish *Pacifastacus leniusculus*	
Rhododendron *Rhododendron ponticum*	
Montbretia *Crocosmia x crocosmiflora*	
Ruffe *Gymnocephaluus cernuus*	
Canada Goose *Branta Canadensis*	
Greylag Goose *Anser*	

6.2 Himalayan balsam

Himalayan balsam is widespread across the catchment and especially so on NT land. Source points are easily identified with mapping and HB management should prioritise walkovers from watercourse source points down to facilitate cost-effective management.

HB is easily spread along watercourses, especially during flood events and therefore beginning management from the source is of paramount importance. There are four HB management methods (strimming, hand pulling, spraying and using the rust fungus biocontrol) set out in table 4 however; a mixture of hand pulling and strimming will be the basis of the Derwent management methodology. A decision making tree for deciding the best management method is included in appendix 3.

Hand pulling HB is the most time consuming HB control method, but when combined with strimming and implemented on a wide scale it is arguably the most effective. HB control through this method has been ongoing for some years across the catchment with guerrilla balsam bashers (individuals across the catchment who pull HB on their own time due to personal interest in their area) and volunteer sessions ran by WCRT and other local charitable organisations. Guerrilla balsam bashers should continue to be encouraged and promoted, as due to the extent of the HB problem it is unrealistic to assume that organisations will be able to tackle the problem alone.

Table 4 Outlining management methods for Himalayan balsam and their suitability/downfalls.

Management Method	Suitability	Downfalls	Where appropriate in the Derwent catchment and how treatment should be carried out
Hand Pulling	- Ensures no part of the plant remains and is incredibly effective. - Great volunteer engagement task, many people like to undertake it on their own time (guerrilla balsam bashers).	- Time consuming and requires large numbers of individuals. - Must be strategic (starting from the source) to ensure most cost-effective action.	- Widespread pulling is the most effective to cause change. - Partners should focus at source points in the upper reaches (identified by base level surveys) and move down the catchment. - Sites should be visited monthly to prevent regrowth. - Guerrilla bashers should be encouraged across the catchment.
Strimming	- Suitable for dense HB stands, where little-no other species survive. - Suitable for trained individuals to undertake, must make sure balsam is strimmed below bottom node, almost to the ground and cut material is mulched with a blade afterwards to prevent regrowth.	- Avoid strimming mid-May – early-June to avoid disturbing native wildflowers. - Can have a coppicing effect if not done properly, Balsam must be strimmed very close to the ground, below the bottom node.	- Strimming should begin in the upper reaches. Strimming should only occur where HB is the dominant plant species - It should be primary method of control, followed by hand pulling. - Sites should be revisited every month to ensure coppicing has not occurred, pulling should be used to manage any regrowth.
Spraying	- Only suitable where no other control method would work. - Should only be used on dense, single HB species stands.	- Expensive - Not specific to HB - Regeneration takes a long time post-spraying	- Very limited areas where spraying is appropriate in the catchment. - Should only be used in locations, which are not suitable for other control methods such as around barns and storage areas the public shouldn't be around or on steep banks it wouldn't be possible to pull/strim on.
Rust Fungus Biocontrol	- Relying solely on hand-pulling/strimming will mean control and eradication will be incredibly slow. Without great public uptake it could be quite ineffectual - The rust fungus limits HB growth and seed production and whilst it does not eradicate the species, the pathogen does act as competition meaning that native species can survive alongside it	- Three different genetic types of HB exist, which all require a different strain of rust fungus and therefore testing and trials are likely to be costly. - Sites for rust fungus introduction currently have to be incredibly specific and cannot be at risk of flooding.	- Areas suitable for a rust fungus release have to go through rigorous testing, cannot be heavily shaded, at risk of flooding and have to be dense stands. - Appropriate areas for a rust fungus introduction are being investigated by WCRT in 2023/24 - NT will investigate areas which meet the specifications in 2023/24

6.2.1 Management of HB through hand pulling and strimming using volunteers and guerrilla bashers

Organisations such as WCRT and NT should focus on eradicating INNS from source points before working on potentially larger patches of HB. E.g., Great Wood should be tackled before The Ings. Source points should be prioritised over other areas of HB by organisations as they are often harder to access and treating them is more cost effective. This should be managed through organising volunteer days and engaging other groups in balsam pulling and engaging the public.

Management should begin in May/June and occur at the same site every four weeks until HB goes to seed in late August/early September. Once HB has gone to seed, management becomes inefficacious and can spread the problem further.

6.2.2 Importance of strimming

There should be an emphasis on using volunteers and where HB is dense, strimming should be prioritised. Strimming should not be used continually throughout the season due to the impact this has on other flowering plants. Using strimmers mid-May-early June should be reserved for dense stands. In 2022, WCRT found it useful having volunteers trained on brushcutters as it allowed for greater usage and over the coming years, WCRT will be training more volunteers in using brushcutters.

Dealing with large areas of HB is more efficient with a brushcutter, if done correctly, as outlined in table 4. Over time, strimming will reduce HB dominance meaning that hand pulling can eventually be the only control method, until rust fungus becomes widespread.

6.2.3 Guerrilla balsam bashing

Engaging the public in HB removal and encouraging it in the public's own time is paramount to ensuring continued management when partners lack funding and/or time. Engagement works best in accessible locations, which may not always be the source. This can be mistaken for taking a 'mosaic' approach to Himalayan balsam control, but the primary expected outcome of encouraging guerrilla bashing is control and widespread engagement. Encouraging guerrilla balsam bashers will occur through:

- Installing leaflet stations on public footpaths through NT land detailing how to correctly hand pull and dispose of HB and encouraging people to do so on their own time.
- Encouraging the public to hand pull on land with public access at volunteer events.

6.2.4 Potential Biocontrol use

Relying solely on hand pulling and strimming to control HB across the Derwent catchment will mean control and eradication will be slow and potentially ineffectual without great uptake from the public and the development of a more widespread, less manually intensive method such as the rust fungus biocontrol. Currently, trials across the UK are ongoing and have had success in some areas, however, trials are currently expensive, with true costs estimated to be around £15000 per site, when monitoring and staff time are taken into account for the two year period (Lawrence, 2023). The rust fungus limits HB growth and seed production and whilst it does not eradicate the species entirely, the pathogen does act as competition meaning that native species can survive alongside it. There are three different genetic types of HB, which all require a different rust fungus strain. Currently, there are two rust fungus

strains available, with the third in the early stages of testing, making rust fungus a viable option for control in the Derwent catchment, should funding become available, as its use greatly decreases staff and volunteer time required to undertake manual control. WCRT and NT should scope out potential rust fungus release sites across 2023-24, with Ings, Great Wood and the upper Cocker looking like potential release sites.

6.2.5 **Therefore, management of HB should:**

- Focus on effective mapping of sources in the upper reaches of the catchment to determine where to begin management.
- Have an emphasis on hand pulling and strimming at source locations from spring-late summer at the same site each month.
- Use volunteers as a low-cost, high-engagement solution at regular volunteer days to both eradicate HB and encourage HB pulling in their own time.
- Encourage the public to pull HB in public areas where there is open access and actively encourage this with signage (which also states we do not accept any responsibility and it is undertaken at their own risk).
- Only spray areas where more ecologically friendly options are not possible.
- Be aware of any biocontrol developments and scope out potential sites for release 2024-25.

6.3 Japanese Knotweed

6.3.1 Japanese knotweed is not as widespread across the catchment as HB but it is still a significant issue in areas where it is present. JK requires annual treatments and after multiple treatments it can mutate and appear more like a creeping ground plant. Treatment options are outlined in table 5, with a decision-making tree in appendix 4.

Table 5 Outlining management methods for Japanese Knotweed and their suitability/downfalls.

Management Method	Suitability	Downfalls	Where appropriate in the Derwent catchment and how treatment should be carried out
Mechanical through hand cutting and brush cutting followed by burning	- Advisable for large stands prior to spraying - Reduces stand size to an easier size for further treatment. - Most ecologically friendly method.	- Does not lead to eradication, but does manage the infestation to a certain level	- Only advisable for large stands prior to chemical treatment
Chemical	- Suitable for autumn months, before the first frost in September-October. - Plant takes Glyphosate in during the nutrient reabsorption phase.	- Needs multiple consistent treatments each year. - Not a specific treatment so any surrounding vegetation may be affected if sprayer is not careful.	- Treatment should occur with Glyphosate, either through injecting 2ml just beneath the second node or through applying it with a spot sprayer at 6l/ha dilution to the leaves. - The solution should be dyed to make it easier to see which plants have been sprayed. - When using herbicides it is important to check future weather conditions (i.e. ensuring it will not be raining for six hours after application). - Once treatment has begun at a site, it should be continued annually until there are no traces of any stands or mutated JK.

6.3.2 Treatment on waterways should begin at the source point, as far up stream as possible. JK only spreads through vegetative means so seed banks are not a worry, however, fragments

breaking off and moving downstream in flood conditions could lead to greater spread and therefore treatment should begin at the most upstream point.

6.3.3 Effective mapping of JK should reveal the points of concern. As it only spreads through vegetative means, in areas where it is not likely to spread fragmentally then treatment can be more specific to the landowner's needs. E.g., the NT can prioritise JK central to a woodland over JK in an open field. Once a comprehensive list of infestations has been compiled, treatment can consist of yearly autumn visits to these sites for treatment, until infestations are eradicated.

6.3.4 Biocontrol trials for JK have been ongoing since 2000, with most focusing on introducing a JK specific psyllid (CABI, 2022). Whilst the psyllid has been effective in causing leaf curling, the psyllid has struggled over winter and therefore has had to be reintroduced multiple years in a row so overwintering assessments are ongoing (CABI, 2022). Due to the current limited nature of JK in the catchment, it is unlikely that the biocontrol will be a viable cost-effective course of action.

6.3.5 Therefore, management of JK should:

- Focus on eradication, as JK only reproduces vegetatively, focusing on a source point is just as important as HB and is more effective.
- Be consistent each year and occur in the autumn just before the plant begins to die.
- Have an emphasis on treatment through spraying.

6.4 American Skunk Cabbage

6.4.1 ASC is found intermittently across the catchment, particularly so in the upper reaches of the Glenderamackin catchment and is not known to be present on any NT land. However, base-level surveys may reveal a greater spread. Despite ASC only being found intermittently across the catchment, the potential damage it could cause means management is a priority.

6.4.2 ASC management requires repeat visits each year and due to its rhizome structure, can take upwards of seven years to ensure eradication. Management of ASC through mechanical removal (digging up the entire plant) is ineffective as both a control and eradication method due to the large underground structure. However, removal of seed heads before they reach maturation is an effective control method to prevent reproduction.

6.4.3 Chemical treatment of ASC should occur in the spring months to be most successful as this reduces seed production. Chemical treatment should be Glyphosate at 6 L/Ha in a spot sprayer, applied to the top and underside of leaves. Treatment should continue each year until ASC are no longer found. Removal of seed heads should go alongside spraying and in cases where ASC cannot be treated that year for any reason, seed head removal should occur as a minimum to prevent further spread.

6.4.4 Ideally, spring treatment should be followed up with a treatment towards the end of summer/beginning of autumn for the best chance of eradication.

6.5 New Zealand Pygmyweed - *Crassula helmsii*

6.5.1 *Crassula* is a concern across the Derwent Catchment due to its efficiency at spreading through vegetative means. It is not present or widespread in all lakes within the Derwent catchment and therefore it is key to ensure that we protect these lakes as much as possible.

There are multiple methods of management for *Crassula*, which have all been outlined in table 6.

Table 6 *Outlining management methods for* Crassula helmsii *and their suitability/downfalls.*

Management Method	Suitability	Downfalls	Where appropriate in the Derwent catchment and how treatment should be carried out
Glyphosate application	- Suitable for emergent and terrestrial populations - 84% effective with a single application, with multiple applications it could eradicate a population.	- Not effective on submerged populations. - Not selective, so kills all other present organisms.	- Very selective as to where it can be used and not particular effective on populations growing in water.
Hot Foam	- A natural product	- Only causes a population decrease of 12%. - Requires the area to be dry.	
Dye treatment	- Can be used for a submerged population.	- Only causes a population reduction of 14%. - Suppresses growth of all other species.	
Mechanical removal	- Cheap and can be done by volunteers	- Often leads to greater spread of *Crassula* as it creates more free-floating fragments.	
Weed control fabric	- Native macrophytes easily regenerate the area after removal. - Leads to 96% reduction.	- Typically left in for six months which can lead to some damage. - Has to be well signposted in a public access area to prevent destruction. - Expensive, as must be applied to all populations in the waterbody to be effective. - Hard to install at depth and often requires divers	- The lowering of the lake level of Crummock Water will expose the current populations, making treatment all the more pressing and more accessible.
Biocontrol mite	- Suitable where populations are emergent/terrestrial for most of the year	- Expensive and still in early trial stages. - Uncertain to its capability to stunt growth on submerged populations. Doesn't eradicate, but can help to control.	- Potentially Derwentwater, depending on the outputs of base level surveys

6.5.2 Eradication plan of Crassula in Crummock Water

Recent reports of *Crassula* in Crummock Water make it a high priority for management. The lake is due to be lowered in 2025-27 with the weir removal by UU which will drop the lake levels by approximately 1.35m. The change in lake levels is likely to turn submerged populations of *Crassula* to emergent populations, which will ease treatment. In contrast, if not managed, the lowering of the lake levels will reveal more viable habitat for *Crassula.*

Research of past management strategies has shown that eradication of *Crassula* in lakes as opposed to ponds is extremely difficult, as creating free floating material only exacerbates the spread (Ewald, 2014). There are limited methods of eradication for *Crassula,* as unless the whole plant can be removed with no fragments left behind, control methods must be laborious, continuous and often damaging to all other native flora and fauna.

Treatment through chemical means (glyphosate spraying, hot foam application and dye treatment) has only proven to reduce cover by between 12-84% and by the following year cover was back up to 100% (ECUS, 2013; Ewald, 2014). Treatment with weed control fabric (WCF) has shown to be 96% effective and the least damaging for other macrophytes present (ECUS, 2013). Unfortunately, no one method has proven to be entirely effective in eradicating *Crassula* and therefore multiple methods will need to be used across multiple years (ECUS, 2013).

Management of *Crassula* in Crummock Water will firstly require mapping the perimeter up to the 3m depth. *Crassula* can only survive up to 3m and Crummock water drops to >3m along most of the lake's edges within a few metres (NNSS, 2022). In March 2023, a team of NT and WCRT staff undertook an initial scoping exercise of Crummock Water to investigate the winter extent of the species. This exercise revealed that the overwintering of *Crassula* occurred in deeper water at the extent of its known habitat, where temperatures are more consistent over winter months. Whilst it proved difficult for the team to have a high confidence in what they were seeing, it did reveal potential locations to re-examine in the summer and proved that treatment pre-weir removal would be tricky due to the depth at which it survives. Further mapping of the bays/lake shore should be carried out in August 2023.

Based upon March 2023 surveys, treatment through using weed control fabric should occur at two separate times. Firstly, outside of the main growing season from October-March. WCF should be placed on the lakebed and shoreline where *Crassula* is present and should extend to beyond where the plant is found to be growing by approx. 1m. Extending the WCF should help to prevent *Crassula* escaping and growing up the sides, as found by ECUS (2013). Ideally, WCF should be installed during low lake levels, although this is hard to guarantee. Installation should ideally occur in 2025-26 after initial works on weir removal have begun as this would be the most accessible time to begin installation. However, beginning works in 2024-25 would be more ideal to begin to reduce the species abundance spread before more habitat is revealed.

WCF will be installed outside of the main growing season to prevent installation disturbing the plant and produce free-floating fragments which would encourage greater spread. However, installing WCF during this season is likely to coincide with higher lake levels and will be trickier to install. Therefore, to attempt to mitigate the impacts this might have, a second phase of installation should occur during low lake levels, to ensure the margins, where *Crassula* is most likely to survive, are well covered. This is most likely to be the following summer.

Weighting down of WCF will be with natural lake materials found on site/around the margins. ECUS (2013) found a 96% reduction in *Crassula* cover the following year when using WCF to cover the lakebeds before the growing season in March. As previously stated, all *Crassula* must be removed to ensure total eradication and therefore the remaining *Crassula* must be dealt with. This is important to remember as it makes it a multi-year project.

After WCF removal, species abundance should be greatly reduced, meaning treatment options are more open to glyphosate, mechanical removal or re-covering with WCF, followed by yearly surveys. ECUS (2013) took vegetation samples post WCF removal and propagated them in the same conditions as the oligotrophic water in which the project occurred. The growing simulation showed that reestablishment of *Crassula* was incredibly minimal, whilst native flora and fauna were able to re-establish incredibly easily.

Treatment through WCF and herbicide spraying will mean that certain areas of the lake will be out of bounds to the public. Crummock Water is a well-known, well-loved lake and therefore community engagement and comms should be included in management. Involving the public in the project should help to decrease any potential vandalism/disturbance to the project, which is unfortunately inevitable if not considered and mitigated through signage.

6.5.3 Presence in other lakes

Whilst management of *Crassula* in Crummock Water has been made a priority in this strategy, the presence of the species in Derwentwater, Bassenthwaite, Loweswater and potentially Buttermere cannot be ignored. Due to the extent of the problem in Derwentwater and the lakes' multi-ownership, management of *Crassula* through WCF has been deemed unfeasible. However, management through a biocontrol mite is a potential for the future and CABI are currently in the early stages of testing the *Crassula* mite. Through undertaking boat surveys in winter and summer the species abundance in the lake can be monitored, to understand its extent and overwintering capabilities. The mite can only survive on emergent and terrestrial populations and needs to be in this form for the majority of the year, but it can survive short term flooding. Mapping of the species will help us to determine if taking part in and paying for experimental trials are feasible. Through controlling the abundance of *Crassula* in Derwentwater the risk of spreading it to other locations in the catchment can be reduced. In the case of Loweswater and Buttermere, if management proves successful at Crummock Water, it is highly likely these two water bodies could also undergo the same treatment.

6.6 Giant Hogweed

6.6.1 GH is currently rare across the Derwent catchment and is only found in coastal regions. However, base-level surveys may reveal a higher distribution than we currently know. Accurately identifying GH is key, as there are native species that look like GH, however fieldworkers will be able to refer to the NNSS guide if in doubt.

6.6.2 As GH has health impacts through its phytotoxic sap it is imperative that instances of GH, especially those in public areas, are dealt with as swiftly as they are spotted and not allowed to continue to spread across the catchment.

6.6.3 Treatment of GH should be through spot spraying glyphosate at 6 L/Ha or injection at ten to one solution into the stem. Either should be carried out in the spring to supress seed production and carried out until the site is entirely free of any traces, with repeat visits made each year.

6.7 Montbretia

6.7.1 Montbretia is widespread across the catchment in ornamental gardens and along roadsides; however, it is currently not widespread along watercourses or areas of concern. Montbretia can easily spread through seeding and due to its underground rhizome structure, is hard to remove.

6.7.2 Base level surveys may reveal montbretia to be more widespread than originally thought. Treatment of montbretia should be through spraying glyphosate at 6 L/ha, prior to seeding. Mechanical removal is a potential control method but would not guarantee eradication.

6.8 Canadian and Nuttall's Pondweed

6.8.1 Both Canadian pondweed and Nuttall's pondweed are of the same Genus *Elodea* and therefore treatment of them has been combined into one plan. Currently, pre-base level surveys, they are both known to be in Bassenthwaite Lake and Derwentwater.

6.8.2 Similar to *Crassula*, both waterweeds can be controlled through mechanical cutting, hand pulling or supressing growth with WCF/jute matting and tend to only be found growing to a depth of 3m (GISD, 2022). Therefore, it is reasonable to assume that where *Crassula* is

found, both waterweeds may also be present and therefore any *Crassula* management will have multiple benefits. If there are found to be areas of *Elodea* where no other invasive waterweeds are present, the same management techniques should be employed in May-July. Management is best when lake levels are low and therefore more *Elodea* is exposed. Similar to *Crassula* the whole plant needs to be removed, as leaving propagules/roots behind will not have any long-term control effects.

6.8.3 Both *Elodea* species are present in Derwentwater, which does not currently have plans for WCF deployment, due to the lake being under multi-ownership and having a high number of visitors and powered crafts. Bassenthwaite Lake is not under NT ownership, making funding for *Elodea* control complex and unlikely. Therefore, whilst the management possibilities of *Elodea* have been outlined above it is acknowledged that control of currently known *Elodea* populations will not be carried out, excluding those instances where control of *Crassula* controls *Elodea* as a by-product in oligotrophic lakes (Crummock Water and Buttermere) where it is thought to not be able to easily survive.

6.9 Mink

6.9.1 Mink can travel many kilometres to find their habitat, with their home range being approximately 2.53km-2.16km (Dunstone and Birks, 1985). Mink are able to travel across large stretches of land in one day across catchments, making eradication extraordinarily difficult, as their ability to repopulate an area is high.

6.9.2 Mink have natural competitors in the form of otters. A more natural catchment with higher levels of otter-suitable habitat will have lower mink numbers (Macdonald and Harington, 2003). One of the most effective and cost efficient methods of mink control is habitat restoration, which is continually being sought after in the Derwent catchment by various organisations and individuals (Macdonald and Harington, 2003).

6.9.3 Relying on other projects to naturally decrease mink numbers as a side effect of habitat restoration is the proposed main management technique for the Derwent catchment as it is the most cost-effective method for a species, which is arguably having a limited impact. Additionally, recent EA publications have revealed that they believe there is no active need for mink trapping, but will support volunteers who wish to undertake it on their own time (EA, 2022).

6.9.4 Further conversations with the EA have revealed that this is down to resourcing issues, as any mink traps require checking daily for animal welfare reasons and not due to their ineffectiveness. Control of mink within the catchment would therefore be beneficial, if resources allow. Due to the complications surrounding mink trapping, it is proposed that any control methods be restricted to staffed traps on NT land where it can be guaranteed they will be checked daily.

6.9.5 To be the most effective, trapping should occur in January-March and aim to kill at least 60% of the breeding population to have an impact, as mink can quickly recolonise an area. Once trapping has begun for a season, it must be continued.

6.9.6 To determine the best locations for trapping, monitoring rafts could be deployed to begin with to understand where mink are present. Reynolds et al. (2004) found that natural field signs of mink and landowners/rangers perceptions of mink presence are not as accurate as raft records and therefore before any traps/control methods are deployed, rafts to survey should ideally be deployed.

6.9.7 If traps are to be deployed, they can be sourced from the EA who are happy to lend them out. It must be stressed once again that spring loaded traps should be checked daily, but the installation of remote cameras (budget and location allowing) would reduce the need for daily checking. Installation of traps should be carefully considered to avoid public footpaths and areas with stock access.

6.9.8 Eradication of mink from the Derwent catchment is unlikely, however, control is possible with a program of trapping in key areas and continued habitat restoration and river restoration works that should naturally increase otter numbers, therefore naturally leading to the decline in mink numbers.

6.10 Ruffe

6.10.1 Ruffe are found within the Derwent catchment and whilst they have been found during electrofishing surveys conducted by WCRT and EA, they are not found in high numbers. Therefore, whilst they are invasive they are not found to be majorly detrimental to the ecology of the catchment, which proves no major need for a comprehensive management plan.

6.10.2 Ruffe should therefore be treated on a kill-when-caught basis. There is no evidence to suggest that a control programme is needed.

6.11 American Signal Crayfish

6.11.1 Crayfish are known to be present in the lower section of St John's Beck and there have been sightings on the Glenderamackin. There have also been unconfirmed reports in other areas of the catchment (Langstrath, Grange). Whilst crayfish have been reported to be in some areas of the catchment, they are not widespread nor is there sufficient evidence to suggest they have the capacity to spread. Therefore, there are no current plans to manage crayfish in the Derwent catchment but WCRT will keep an informal eye on crayfish numbers through electrofishing surveys and any concerning changes will be reported to the EA, who agree with this approach. Any crayfish caught will be killed, as is required under law.

6.12 Rhododendrons

6.12.1 Rhododendrons are not widespread along the catchment's watercourses and therefore there is little active control of them. However, they are a known problem on NT land and there have been past efforts to control it, mainly through cutting and burning.

6.12.2 The Forestry Commission has created a guide to managing and controlling rhododendrons, which is incredibly comprehensive and applicable to any area. As such, it is not necessary to rewrite a rhododendron management plan for the Derwent catchment, as there is already an applicable one in existence.

6.12.3 Base level mapping to determine the age of rhododendron plants should be carried out initially and the oldest plants with the highest level of seed production tackled first.

6.12.4 Cutting and burning material before treating the stumps with herbicide to the time scale described in https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/698576/managing_and_controlling_rhododendron.pdf will control the spread of rhododendrons on NT land.

6.13 Geese (various)

6.13.1 This management plan will cover all invasive geese currently present in the catchment including Canada, Greylag and Barnacle. These species are present on NT land. The NT have monitored and controlled Canada geese numbers for a number of years through egg pricking and liaising with any farmers who have active licenses to shoot. Due to their nature to rapidly reproduce and relocate, it is hard to eradicate their populations from the catchment and due to the consistency with which egg pricking has occurred, any disturbance to this schedule would cause the population to increase.

6.13.2 Controlling Canada geese through pricking does not require a license; however, greylag and barnacle goose management does require a license, which the NT will aim to obtain in 2023/24 to begin management of all invasive geese. Once pricking has begun, a programme of control must continue undisturbed.

6.14 Grey Squirrel

6.14.1 Red squirrels are present throughout the Derwent catchment and therefore it is key that there is continued work to control grey squirrels in the catchment. Fortunately, there are multiple volunteer groups across the catchment who monitor and manage squirrel sightings. This includes Keswick Red Squirrel Group, Allerdale Red Squirrel Group and Binsey Red Squirrel Group. The NT currently work with the Keswick Red Squirrel Group where they need help, but the group is reactive to all sightings.

6.14.2 The progress of these groups should be monitored by the NT on their land to ensure that all areas are covered, if it appears there is a gap in the groups' monitoring efforts then the NT should work with the group to help where required.

7 Objective 3: Develop a strategy to reduce the risk of new INNS being introduced to the catchment

7.1.1 Preventing INNS from being introduced to the Derwent Catchment is possible through increased biosecurity measures and policing of potential introduction pathways. Currently, within the catchment there are limited prevention methods, limited further by a lack of partner coordination. The best method of prevention is through biosecurity methods, to increase awareness, educate the public and reduce the risk of introduction. The risk of introduction refers to both the risk of spread within the catchment itself across waterbodies and the introduction of new to the catchment INNS.

7.1.2 New to the Derwent Catchment INNS includes those that may be in the country but not in the catchment and those that may not be in the country at all. These INNS are listed in table 10, and their colour coded risk rating is outline in appendix 1. Some of these species not yet in the country have a low Derwent rating despite their high RIMP rating as the risk of introduction to the catchment is relatively low, based on the risks posed by the pathways of introduction outlined in Table 7. Similarly, some of these INNS are rated higher despite a lower RIMP rating as they would cause irreversible ecological damage.

7.1.3 To determine how to prevent introduction, pathways must be risk assessed and then the measures to reduce the risk outlined.

7.2 Risk assessments of pathways

7.2.1 The Northern RIMP (2018) defined a mechanism for risk assessing sites and events for potential INNS introductions and establishment. Risk assessing every site within the INNS catchment is not necessary, and there is a lot of overlap on risks between sites. However, the different pathways of introduction to the Derwent catchment all present different risks, which are outlined roughly in the Northern RIMP.

7.2.2 Pathway Action Plans are being created by the GBNNSS and aim to prevent or manage the risk posed by these pathways. The PAPs have been prioritised on a GB level and are continually being updated by GBNNSS, to define the biosecurity standards required to prevent INNS introduction. They are key for reducing the risk of new INNS on a national level; however, the Derwent catchment needs a more specific approach to address INNS which are a risk nationally, regionally and specifically to different waterbodies. This has been addressed in table 7, which outlines the pathways and their risk rating.

Table 7 a risk assessment of potential pathways of INNS introduction

Pathway number	Potential Pathway	Potential Risks	Rating before mitigation methods	Groups to target for improvement
1	Angling	There are multiple angling associations within the Derwent catchment and a lot of biosecurity work has been carried out with them in the past. Biosecurity protocols are well known in these groups and is signposted on their websites and when purchasing a permit.	Low	Angling clubs
2	Freshwater Recreation- Marshalled events	All waterbodies within the Derwent catchment are part of the LDNP and are either part owned, or fully owned by the NT. Past INNS work has been successful in monitoring and attending these events and as such, they all have biosecurity protocols included in their organisation to some extent. Most of these events have designated washdown stations and require competitors to clean their kit either before or/and after the event.	Low	• Derwentwater Regatta/ Epic lakes swim Derwentwater • Buttermere Bash • Bassenthwaite sailing club events, including triathlons • Lakesman triathlon
3	Freshwater Recreation- un-marshalled events	This includes events and challenges such as the Frog Graham and Frog Whitton. These challenges are multi-lake in nature and are not marshalled; instead the individual carries them out in their own time. There are no biosecurity measures enforced, only the implication that competitors should check, clean and dry their wetsuits in between lakes. Whilst there is information on the websites for these events to promote biosecurity, there is no guarantee that competitors are following the protocols. Additionally, the routes for the events are devised in a way that means that pristine lakes are swum in after competitors have swum in lakes that have INNS. This makes the risk of spreading INNS across the lakes high, but the overall biosecurity risk is medium.	Medium	• Frog Graham • Frog Whitton • Local athletic clubs • Local triathlete clubs
4	General Freshwater	The LDNP receives 17 million visitors annually, with many coming to enjoy the lakes through swimming, SUPing, kayaking and canoeing. In recent	High	• Kayak and canoeing clubs

Pathway number	Potential Pathway	Potential Risks	Rating before mitigation methods	Groups to target for improvement
	Recreation (including wild swimming, SUPs, kayaks, canoes and other recreational boat vehicles)	years, the popularity of these activities has increased and their accessibility is high due to the relatively low cost of equipment and no need for any training in order to operate any of the equipment. This means that there is a low understanding of biosecurity practises, especially cleaning equipment before entering another waterbody. These practises are also unmonitored and therefore there are no enforced biosecurity measures or a consistent learned behaviour. Visitors are also coming from all across the country, not just the Derwent catchment, making it tricky to target the entire audience.		• SUP clubs • Wild swimming clubs • Landowners (e.g. National Trust, marinas, lake side properties) • Outdoor centres/outdoor education providers • The entire general public
5	Garden escape/accidental release	This includes accidental release when undertaking construction works, garden waste disposal, the transfer of soil/land, accidental release from gardens and intentional introduction. Biosecurity policies as part of construction works are routine and should be followed/maintained. Accidental and intentional release are tricky to monitor and pinpoint however, occurrences are lower than they used to be.	Medium	• Local councils • EA • Natural England • Garden Centres • General Public

7.2.3 The risk rating of these pathways can be reduced through biosecurity practises outlined in this section, which will raise awareness of the pathways and how to reduce the risks.

Table 8 proposed biosecurity measures and the pathways they will reduce the risk of

Biosecurity measure	Pathway it will help to mitigate
Update biosecurity materials available to loan for events, have a central system for storing them and publicise on the relevant websites.	- Angling - Freshwater Recreation, marshalled and un-marshalled events
Increase biosecurity messaging through public channels such as social media and increase messaging throughout summer.	- Angling - General Freshwater Recreation
Increase event attendance and create a list of effective ones to attend	- Freshwater Recreation- marshalled events
Install washdown stations at access points	- Freshwater Recreation- un-marshalled events - General Freshwater Recreation
Develop a biosecurity champion/guardian for access points/waterbodies	- Freshwater Recreation- un-marshalled events - General Freshwater Recreation
Purchase a portable washdown station for events and peak summer days, publicise where needed	- Angling - Freshwater Recreation, marshalled events - General Freshwater Recreation

7.3 Develop a biosecurity champion/guardian for access points/waterbodies

7.3.1 The AQUA biosecurity accreditation scheme ran by Bristol Zoo aims to promote and improve biosecurity at waterbodies through awarding water bodies 3 rating levels (bronze, silver and gold), obtained through biosecurity practises which hope to improve the lake. Any water body can aspire to gain these awards, following the guidance set out by Bristol Zoo.

7.3.2 This scheme has been through its pilot phase and is now being rolled out on a wider scale across the country. Most of the mitigation methods for the pathway are required for this award.

7.3.3 The scheme requires check, clean, dry signage to be present at access points, setting up a chain of reporting for new INNS, annual reporting on INNS present in the waterbody, a completed biosecurity risk assessment, raising awareness of biosecurity and a designated volunteer site guardian to promote biosecurity and look out for new introductions. The scheme encompasses almost everything that needs to be in place for the lakes in the Derwent catchment and therefore the scheme will be explored. Derwentwater will be the first lake to aim for, due to this being the lake with the most INNS, visitors and events, with other lakes added to the scheme in following years.

7.3.4 Through taking part in the AQUA biosecurity accreditation scheme on Derwentwater we can work with local water users to improve biosecurity. In order to achieve the bronze award, a volunteer site champion must be appointed to promote biosecurity and the prevention/control of INNS at the site. As Derwentwater is such a large lake with many access points, a number of volunteer site champions may need to be appointed. Advertising of this can be jointly managed by WCRT and NT. This is likely to be the most complicated part of the award, as the

other aspects can be handled through partner coordination. The targets and actions proposed to meet those targets are outlined in table 9.

Table 9 the requirements that must be net to achieve Bronze Aqua Accreditation and the actions to meet them

Requirement for Aqua Accreditation	Further info and actions to achieve the requirement
Submit a site form	
Carry out an annual biosecurity risk assessment of the site	
Submit an anecdotal list of reported INNS and annually submit a monitoring report	Already an aim of this strategy, to map the INNS on Derwentwater
Report new INNS sightings to the designated biosecurity person	Covered through objective 1, as part of the mapping strategy, and objective 4, as part of the response strategy
Black listed and GB alert species reported to the appropriate external bodies	
CCD signs, posters and info displayed	An aim for summer 2023 at access points on Derwentwater and other waterbodies in 2024
A key biosecurity person assigned and staff members trained in biosecurity	An aim of this strategy is to train rangers and project officers, through the GBNNSS online training and a training programme delivered by WCRT
Facilitate visitor biosecurity through providing advice on cleaning	Can be done through providing materials at access points
Host biosecurity awareness raising events	Aim to visit events and raise awareness in car parks. Travelling portable washdown stations
Raise awareness in INNS week	An aim of cross partner collaboration
Appoint a volunteer site guardian	Potentially the most complicated aim to achieve,

7.3.5 Starting out with aiming for Bronze at Derwentwater in 2023 should set the DIP up for aiming for Bronze at other sites in 2024, therefore ensuring biosecurity practises are upheld across the catchment. Involving the public in this through taking on site champions and training them could prove problematic as it involves volunteer coordination.

7.4 Update and install signage at access points to promote biosecurity practises

7.4.1 Signage to promote biosecurity best practise and denoting the target INNS to look out for is a standard biosecurity mechanism that is widely used. Placement in easy to see, frequently used access points will educate members of the public on how to properly check, clean and dry their equipment fully.

7.4.2 Signage is a low-cost, low-maintenance and highly effective mechanism to promote biosecurity practises. Using the same, consistent signage across the Derwent catchment (instead of changing signage based on landowner or availability) will deliver a united message. Signage should include:

- Check, clean, dry messaging with information on how to do each one
- Target INNS to look out for, including New Zealand Pygmyweed, killer shrimp and floating pennywort
- How to report an INNS sighting
- Where to find out more information

7.4.3 Installing signage aims to educate a wider cross section of the public than can be targeted at events and on social media. It targets individuals on site as they undertake the activity.

Investment in signage across the Derwent catchment has not been considered before as there have been funding issues and there are concerns it is not 100% effective. However, a multitude of approaches is required to tackle biosecurity.

7.4.4 As part of the GBNNSS Check, Clean, Dry campaign signs are available free of cost from the GBNNSS. Whilst they are incredibly effective in communicating biosecurity protocols, they are generic signs and therefore do not communicate the species the Derwent catchment is most at risk of. Signage that also communicates the species to be aware of would be the most beneficial. However, should funding for signage be limited, using the GBNNSS signage will suffice and qualifies as sufficient signage under the AQUA accreditation scheme.

7.4.5 Signage is already being developed by the NT for installation around Derwentwater and will be rolled out in summer 2023. Signage itself and its impact should be monitored over the season to observe how well received it is and if any vandalism occurs. If successful, signage should be installed in the following locations:

- Derwentwater landing stages/carpark NY26416 22782
- Derwentwater, Crow Park NY 26348 22866
- Derwentwater Isthmus entrance NY 26233 23215
- Derwentwater, Calfclose Bay NY 27020 21367
- Derwentwater Ashness Landing NY 26877 20422
- Derwentwater Kettlewell NY 26702 19525
- Derwentwater Marina NY 25462 23165
- Crummock Water Lanthwaite wood NY 15202 20875
- Crummock Water, boat house NY 15497 20562
- Crummock Water, near Woodhouse islands NY 16719 17673
- Crummock Water, Rannerdale NY 16280 18316
- Buttermere, Buttermere Shore NY 17371 16447
- Buttermere, Lower Gatesgarth NY 19105 15506
- Buttermere, Hasness Crag Wood NY 18769 15860
- Loweswater, Maggies Bridge, NY 13459 21014
- Loweswater, Holme Wood NY 12344 21408
- Loweswater, road side under Darling Fell NY 12372 22137
- Bassenthwaite, Dubwath
- Bassenthwaite, Ouse bridge NY 20122 31940
- Bassenthwaite, Scarness NY 22109 27334

7.4.6 Derwentwater should be the priority lake for signage in 2023 followed by the other three NT owned lakes in 2024. Bassenthwaite is not under NT ownership and therefore funding and installing signage is likely to take more time and resources.

7.5 Update biosecurity materials available to loan for events, have a central system for storing them and publicise on the relevant websites

7.5.1 In addition to having signage at access points, having materials ready to loan to clubs and events such as leaflets, posters and washdown equipment will help to educate the wider public on biosecurity practises. Small events run by kayak/SUP clubs require fewer permissions and therefore often fly under the radar for imposing biosecurity measures. However, the organisers of these events, despite biosecurity measures not being enforced, are often aware that measures are required. In the past WCRT have kept a bank of materials on hand and have gladly lent them out to organisers. In 2022, WCRT developed a WCRT specific area check, clean, dry leaflet as well as obtained more GBNNSS CCD materials. WCRT are happy to hold biosecurity materials and loan them out to event's organisers as and when required.

7.5.2 This will also be publicised on the WCRT website and WCRT are happy for events to be referred to them. Unfortunately, there is not the staff time to research every small event/club meet and distribute materials to everyone, but through making materials available and advertising so online there will be greater uptake of this service. In addition to this, WCRT will be updating the INNS section of the website to include clearer information on events materials and CCD information.

7.6 Increase biosecurity messaging through public channels such as social media and increase messaging throughout summer

7.6.1 Using multiple methods of communication will help to spread information on INNS in a more effective way and reach more of the intended audience. One of the proposed ways to do this is through increasing social media posts throughout summer and consistently posting across platforms with sharing of posts by partners.

7.6.2 This will be started in INNS week 2023 and continue throughout the summer with biosecurity posts, advertisement for a Derwentwater guardian and posts regarding Crassula in Crummock Water.

7.7 Increase event attendance

7.7.1 In recent years, WCRT have found that attending events and summer shows for raising awareness on biosecurity has not been beneficial to this purpose. There are potential explanations for this including that WCRT are not that well known outside of Cumbria and that potentially the wrong events have been attended.

7.7.2 The following events have been highlighted as potential events for biosecurity awareness raising and also as potential biosecurity risks:

- Lakesman Triathlon
- Bassenthwaite Triathlon
- Derwent Triathlon
- Buttermere Bash
- Derwentwater Regatta
- Bassenthwaite Regatta

7.7.3 Most of these events do have biosecurity protocols, however, increasing awareness and explaining why these protocols are upheld is not a priority of these events. Therefore, attending these events with educational materials could be beneficial, if there is time available. It has been assessed that whilst this is a priority pathway, it is not the highest priority, yet the potential to educate a wider audience makes it beneficial.

7.8 Purchase a portable washdown station for events and peak summer days, publicise where needed

7.8.1 As assessed in table 7 general freshwater recreation is the highest risk pathway for the Derwent catchment. This pathway therefore requires the most mitigation. As already discussed, increasing signage and social media messaging on biosecurity practises hopes to reach a wider audience on how to stop the spread. Additionally, a physical presence from partners with the information on why and how to CCD would be beneficial to implement the process.

7.8.2 Washdown stations require correct infrastructure to ensure that wastewater is properly disposed of and does not enter the lake, which would render the exercise futile, in some cases. The messaging on washdown stations and their intended purpose (to prevent INNS entering or to prevent INNS leaving) should be clearly communicated at each point.

7.8.3 At sites on Derwentwater the key message should be to washdown on exit, to prevent INNS leaving the water. However, at sites on Crummock Water and Buttermere INNS should be prevented from entering the water and therefore the key message is to wash down before and after. This causes issues with wastewater disposal, as it cannot enter the lake/river as this is effectively causing the same issue. Wastewater needs to run onto a hard surface to dissipate, allowing potential INNS plants to be left behind before entry into the wastewater system. The process of checking before cleaning should allow any INNS to be found at this stage to prevent them potentially being washed into the system. Having a manned washdown station allows for the correct process to be taught so that un-manned permanent washdown stations can be used correctly.

7.8.4 A portable washdown station is a relatively cheap and effective way of reducing the spread of INNS across the Derwent catchment. It can be transported to different sites, lent out to events, clubs and partners and can be monitored by a trained member of staff, to ensure its proper use. By making it portable, the kit can easily be taken to different locations, reaching a larger proportion of the population.

7.8.5 The NT should consider purchasing a portable washdown station to be lent out for events and for rangers/ car park attendants to travel with. This will allow rangers at frequently used access points to have biosecurity equipment on site at peak times and spread the CCD message. Potential areas to attend with the washdown station include:

- Kettlewell car park
- Ashness Jetty
- Calfclose Bay
- Isthmus
- Lanthwaite Wood
- Crummock water shore, Woodhouse Islands
- Buttermere shore

7.8.6 Signs with instructions of how to operate washdown stations can be found on the GBNNSS website. This allows for the ranger/project officer on site to not constantly monitor it, allowing them to carry out their other duties.

7.8.7 Both WCRT and NT can also take the washdown station to events such as those listed in 7.7.2, to raise the profile of both trusts and attract a wider audience.

7.8.8 As these washdown stations are portable and dependant on a staff member transporting and operating it, they incur costs. Additionally, as they are not permanent fixtures they cannot entirely fix the problem nor should they be treated as the sole way to stop the spread. It should be viewed as an educational tool, to educate the public on how to use washdown stations and how to CCD equipment.

7.9 Install washdown stations at access points

7.9.1 One of the most effective ways to stop the spread of INNS is through ensuring water users have access to washdown facilities to washdown prior to and/or after leaving the water. It is important to define which function the washdown facility is geared towards, as each function has a different specification and needs different messaging.

7.9.2 Washdown stations, which promote washing kit down before, or before and after water use need to have a freshwater supply and runoff must be into a soakaway, not into the water source. These washdown stations need to be clear that prior washing down is to prevent any potential species from other locations being introduced, but also make it clear that washing down on exit will prevent species from being spread out of the site. This kind of washdown station is the most expensive and problematic to install, as it requires a freshwater source and a drainage system. Additionally, due to the popularity of the Derwent catchment there are concerns that washdown station drainage points would be used as public toilets and/or emptying points for campervans/motorhomes. The design and placement of these washdown stations should therefore be in areas that will see heavy use (such as Kettlewell carpark and Derwentwater landing stages) and that are regularly patrolled by the NT.

7.9.3 Washdown stations that only promote the washing down of kit on exiting the water require less infrastructure and are therefore less of a logistical problem. Washing down on exit from the water means that lake water can be used and washed back into the lake, meaning a simple pump and signage is all that would be required. Unfortunately, this kind of washdown station only works when correctly and clearly signposted and assumes that individuals have washed kit down prior to entering the lake. Therefore, despite it being the most low cost option and easiest to install, it is only suitable for locations where INNS need to be prevented from being spread (Derwentwater), not locations where INNS need to be prevented from being introduced (Crummock water and Buttermere). Additionally, if permanent washdown stations are being installed it makes sense in the long-term to install washdown stations to be used on both entry and exit.

7.9.4 The logistics involved with installing washdown stations including obtaining planning permissions, creating a sustainable design, and upfront and maintenance costs means that installation could take multiple years. Wastewater disposal is likely to be a major sticking point that could lead to a struggle for installation. By purchasing a portable washdown station in 2023 it allows for flexibility in installing a permanent washdown station, which is a priority.

7.10 Pathway reassessment

7.10.1 We have identified two major shortfalls in biosecurity in the Derwent catchment: there is not enough information on how to practise biosecurity and there is not the correct equipment for carrying out these practises. Thorough increasing signage at key access points, the public will be provided with the information of how to stop the spread. Through increasing social media output we hope to reach a greater audience base. Through purchasing and touring with a portable washdown station, general freshwater recreation users will have access to the tools to properly check, clean and dry their equipment. Installing a permanent washdown station in the next couple of years will also help increase the understanding of CCD and stop the spread. These mitigation methods should help to reduce the risk of introduction from general freshwater recreation, angling and accidental/garden release.

7.10.2 Events to be aware of have been listed in this strategy and their biosecurity protocols should be understood and examined at periodic intervals to ensure their risk does not increase. Non-marshalled events (such as the Frog Graham and Frog Whitton) have been raised with the APHA inspectorate and we are awaiting their advice on these matters.

7.10.3 Therefore the actions to prevent the spread of INNS in the Derwent catchment are as follows:

- To increase signage across the catchment at key access points

- Increase social media presence and messaging of campaigns such as check, clean, dry; stop the spread and be plant wise
- Periodically check events are following biosecurity protocols
- Purchase a portable biosecurity washdown station which can be toured around sites in the summer and lent out to events
- Continue to work on installing washdown stations on Derwentwater

8 Objective 4: Develop a sustainable identification and reporting methodology, which can be used long-term and benefits multiple organisations

8.1.1 Objective three identified how to reduce the risk of new INNS being introduced into the catchment and outlined the new prevention mechanisms to be deployed. Whilst prevention is a key action, there must also be a comprehensive plan for surveillance, detection and monitoring should prevention efforts fail.

8.1.2 Detection of new INNS and monitoring of their spread will be covered by objective one, which allows for new INNS sightings to be reported. To facilitate this, surveillance mechanisms should be improved through comprehensive training provided to partners and groups who are likely to come into contact with new INNS (such as canoe clubs, wild swim groups etc.).

8.2 INNS surveillance training

8.2.1 As part of the AQUA accreditation scheme, staff should be trained in biosecurity using the GBNNSS e-learning. As part of this strategy, by 2024, all colleagues should have modules 1-3a completed. Additionally, WCRT will be developing a training plan for partners in 2023, to deliver training sessions on biosecurity, ID and reporting. Through delivering these sessions and ensuring partners complete the online training, there will be an increased level of surveillance across the catchment, allowing for greater detection capabilities.

8.2.2 Surveillance training of partners will ensure that those who are frequently on the ground, in sensitive habitats or potential hotspots will have the skills to be able to identify species and know the defined catchment protocol for a new INNS sighting. Currently, with a lack of partner coordination there is no defined process for reporting new INNS. If a partner has a report sent to them by the public or witnesses something themselves, there is no protocol for what to do with this information and no defined data flow. As stated in objective one, INNS sightings should be reported through this mechanism as this will help us to understand the spread of INNS across the catchment. However, this is not appropriate in the case of black listed species, GB alert species or species of EU concern. There are multiple species for which reporting to the DIP map is not sufficient and therefore a more defined data flow and response protocol most be defined.

8.2.3 In addition to surveillance training for partners, surveillance training and biosecurity training should be offered to local groups such as wild swimmers, water sports groups and anglers. Through providing them with the opportunity to learn more about biosecurity, what INNS to be looking out for and how to report new sightings, surveillance can be increased across the catchment.

8.2.4 Training for both partners and the public will be developed in spring 2023 and will be advertised on the WCRT website in summer 2024, with pilot runs in this time.

8.3 Response mechanisms

8.3.1 Once a new INNS has been detected in the Derwent catchment there needs to be a response protocol so that eradication can be quickly achieved before more costly control mechanisms are required.

8.3.2 In the case of all INNS sightings, they should generally all be reported to the WCRT project officer for verification, before being passed on to the relevant body. In the case of there being no project officer due to lack of funding or for any other reason, table 10 details whom such INNS would be reported to once verified by the project officer. Some species in Table 10 may appear unlikely to be introduced to the Derwent catchment (e.g. Racoon, Chinese Mitten Crab and other marine species); however, they have been included due to their national rating, to ensure that the list is inclusive. Through defining the general protocol of reporting new INNS sightings to WCRT and scaling up this, it aims to reduce the number of reports to national bodies and ensure verification. Additionally, national bodies will have different funding priorities and resourcing capabilities and therefore through reporting so within the catchment to begin with a catchment-based response can begin. This is particularly applicable in the case of INNS on the GB Alert List.

8.3.3 The detailed national body to which to report a new sighting is based upon a species status, be this its status as a GB Alert species, the EU Species of Concern list or its rating under the Northern RIMP. Table 10 shows various bodies an INNS sighting should be reported to, as who it is reported to will vary based upon location of sighting.

Table 10 *outlining whom an INNS sighting should be reported to if spotted in the catchment and what the response protocol to this should be.*

Species	Derwent rating	Who to report sighting to	Response Protocol
Killer shrimp *Dikerogammarus villosus*		APHA Inspectorate EA NE	No current approved eradication method, containment through strict biosecurity measures only current option.
Demon shrimp *Dikerogammarus haemobaphes*		APHA Inspectorate GBNNSS EA NE	No current approved eradication method, containment through strict biosecurity measures only current option.
Bloody red shrimp *Hemimysis anomala*		APHA Inspectorate EA NE	No current approved eradication method, containment through strict biosecurity measures only current option.
Topmouth gudgeon *Pseudorasbora parva*		APHA Inspectorate GBNNSS EA NE	An EA led response has occurred before, which led to the eradication of all known populations. Should any populations be identified, EA have a pre-prepared response protocol to enact.
Floating pennywort *Hydrocotyle ranunculoides*		EA NE	See section 8.4
Curly waterweed/curly water-thyme *Lagarosiphon major*		EA NE	See section 8.5
Asian Hornet *Vespa velutina*		APHA Inspectorate GBNNSS EA NE	Response is led by GBNNSS, any sightings should be reported through the Asian Hornet Watch App
Quagga Mussel *Dreissena rostriformis bugensis*		APHA Inspectorate EA NE	See section 8.6

Species	Derwent rating	Who to report sighting to	Response Protocol
Zebra mussel *Dreissena polymorpha*		APHA Inspectorate EA NE	See section 8.6
Chinese mitten crab *Eriocheir sinensis*		EA NE	No current approved eradication method, containment through strict biosecurity measures only current option.
Water primrose *Ludwiga grandiflora*		APHA Inspectorate EA NE	There is an ongoing EA led eradication programme; all incidences should be reported to the EA for further instruction.
Water fern *Azolla filiculoides*		EA NE	See section 8.7
Purple pitcherplant *Sarracenia purpurea*		APHA Inspectorate GBNNSS EA NE	GB Alert Species, but immediate control through hand pulling can begin when species is confirmed.
Giant knotweed *Fallopia sachalinensis*		EA NE	See section 6.3 for Japanese knotweed control method, which can be applied to giant knotweed in the same way.
Hybrid knotweed *Fallopia x bohemica*		EA NE	See section 8.9
Himalayan knotweed *Persicaria wallichii*		EA NE	See section 8.9
African sacred ibis *Threskiornis aethiopicus*		APHA Inspectorate GBNNSS EA NE	Subject to the GBNNSS contingency plan for invasive non-native terrestrial species so a sighting would trigger the response protocol set out by the Response Group.
Parrot's feather *Myriophyllum aquaticum*		APHA Inspectorate EA NE	See section 8.10
Zander *Sander lucioperca*		APHA Inspectorate GBNNSS EA NE	See section 8.11
Black bullhead *Ameiurus melas*		APHA Inspectorate GBNNSS EA NE	EA led eradication programme in the past led to eradication from England. Any sightings should be reported to the EA to enact this plan.
Creeping water-primrose *Ludwigia peploides*		APHA Inspectorate GBNNSS EA NE	Subject to the GBNNSS contingency plan for invasive non-native freshwater plants so a sighting would trigger the response protocol set out by the Response Group.
Fanwort *Cabomba caroliniana*		APHA Inspectorate GBNNSS EA NE	Only one invasive population in the UK and therefore no generic response protocol. A GB alert species.
Broadleaf watermilfoil		APHA Inspectorate	Subject to the GBNNSS contingency plan for invasive non-native

Species	Derwent rating	Who to report sighting to	Response Protocol
Myriophyllum heterophyllum		GBNNSS EA NE	freshwater plants so a sighting would trigger the response protocol set out by the Response Group.
Water hyacinth *Eichhornia crassipes*		APHA Inspectorate GBNNSS EA NE	Subject to the GBNNSS contingency plan for invasive non-native freshwater plants so a sighting would trigger the response protocol set out by the Response Group.
American needle-grass *Nassella neesiana*		APHA Inspectorate GBNNSS EA NE	Subject to the GBNNSS contingency plan for invasive non-native terrestrial plants so a sighting would trigger the response protocol set out by the Response Group.
Wireweed *Sargassum muticum*		EA NE	Eradication in other areas has failed, however establishment in the Derwent catchment is unlikely as there are no oyster farms. Should Wireweed be reported, biosecurity is the only viable option currently (Davison, 2009).
Wakame/Japanese kelp *Undaria pinnatifida*		EA NE	Eradication in other areas has failed as the species reproduces via spores, making it hard to guarantee eradication. Establishment is unlikely in the catchment, however, should it be reported, enhanced biosecurity is the most resource-efficient option (Epstein and Smale, 2017).
American bullfrog *Lithobates catesbeianus*		APHA Inspectorate GBNNSS EA NE	Subject to the GBNNSS contingency plan for invasive non-native terrestrial species so a sighting would trigger the response protocol set out by the Response Group.
Racoon *Procyon lator*		APHA Inspectorate GBNNSS EA NE	Subject to the GBNNSS contingency plan for invasive non-native terrestrial species so a sighting would trigger the response protocol set out by the Response Group.
Racoon dog *Nyctereutes procyonides*		APHA Inspectorate GBNNSS EA NE	Subject to the GBNNSS contingency plan for invasive non-native terrestrial species so a sighting would trigger the response protocol set out by the Response Group.
Tree groundsel *Baccharis halimifolia*		APHA Inspectorate GBNNSS EA NE	Report to inspectorate for further instruction, there have been previous GBNNSS eradication programmes as it is a GB Alert Species.
Ruddy duck *Oxyura jamaicensis*		APHA Inspectorate GBNNSS EA NE	EU led eradication programme, report to GBNNSS for further information.
Giant Rhubarb *Gunnera* - various			See section 8.12
Marbled crayfish *Procambarus marmorkrebs*		APHA Inspectorate GBNNSS EA	Subject to the GBNNSS contingency plan for invasive non-native freshwater animals so a sighting

Species	Derwent rating	Who to report sighting to	Response Protocol
		NE	would trigger the response protocol set out by the Response Group.
Spiny-cheek crayfish *Orconectes limosis*		APHA Inspectorate GBNNSS EA NE	See section 8.8
Virile crayfish *Orconectes virilis*		APHA Inspectorate GBNNSS EA NE	See section 8.8
Red swamp crayfish *Procambarus clarkii*		APHA Inspectorate GBNNSS EA NE	See section 8.8
Slipper limpet *Crepidula fornicata*		APHA Inspectorate EA NE	Introduction to the catchment unlikely due to lack of port or oyster beds. However, if introduction did occur, manual removal and continual monitoring would be the best course of action considering the infestation is likely to be minimal.

8.4 Floating Pennywort Response Protocol

8.4.1 In the first instance that floating pennywort in found within the Derwent catchment, the EA should be alerted to the presence, as its spread is likely to be rapid due to its ability to grow quickly. Therefore, swift eradication and containment should be the first priority.

8.4.2 The site should be cordoned off from the public if possible, and stop nets or similar should be placed around the contaminated area in the water to prevent any fragments from moving downstream. The first infestation of floating pennywort would hopefully be limited and therefore mechanical removal should be effective, as per the RAPID Best Management Practise Floating Pennywort Guide (2018a). Mechanical removal can be done at any time of the year, especially so with a small infestation.

8.4.3 Mechanical removal should ensure the whole plant is removed and no propagules are left behind. Follow up chemical treatment can be used to treat emergent populations and those on land at the end of the growing season.

8.4.4 Communication with the public, especially signage at the site, is extremely important to ensure containment.

8.5 Curly waterweed response protocol

8.5.1 Access to the site should be restricted as soon as the species sighting is confirmed and signs erected to alert to the population and prevent spread. Due to the species preferred habitat, it is likely to be found in a lake within the Derwent catchment rather than a river, and it can survive at greater depths than Crassula. Unfortunately, this means that in order to know what

management technique to deploy, extensive surveys will have to be carried out before even deploying a response control method.

8.5.2 Once the extent of the infestation has been determined, a timeline can be established for eradication through using jute matting and the method deployed at Lough Corrib, as outlined in the RAPID Good Practise Management Guide for Curly Waterweed (2018b). This method is expensive, often requiring divers, large teams and boats and therefore acquiring funding for such an exercise is likely to be a lengthy undertaking. Should curly waterweed be found in the catchment, it will be a multi-year response, requiring partner coordination to obtain the funding, staff and equipment to map and manage the curly waterweed. Therefore, signage and communication are key in initial identification of a population.

8.6 Quagga mussel/Zebra mussel response protocol

8.6.1 An infestation of either invasive mussel will be in large quantities and easily spotted. Management should occur through manual removal and either freezing for 24 hours or desiccation in a bio secure unit (i.e. not on the side of the waterbody in which they were found) (RAPID, 2018c). Removal can occur as soon as the population is confirmed, however it will have to continue for a number of years as removal of mussels does not guarantee removal of larvae and new populations may establish.

8.6.2 As mussels in the larval stage may be present, enhanced biosecurity practises must be communicated to the public, to prevent spread across the catchment and further afield. Boats are the most likely to spread mussel populations through any water in any crevices so increased signage should be deployed at the site where mussels are found.

8.7 Water Fern response protocol

8.7.1 Water fern is best controlled through use of a biocontrol, which is already present in the UK and readily available to the public. The weevil has led to eradication in some areas.

8.7.2 There have been EA led eradication programmes in the past which should be explored, however, whenever the funding becomes available for a rapid response, weevils should be released in spring and increased biosecurity practises encouraged to prevent further spread.

8.8 Spiny-cheek crayfish, red swamp crayfish and virile crayfish response protocol

8.8.1 The Derwent catchment does not have the correct water composition to support crayfish populations, with no natural white-clawed crayfish populations. However, non-native signal crayfish have established in a sub-catchment and whilst they are not invasive to the catchment, they are present. This therefore suggests that if another invasive species of crayfish were introduced to the catchment (likely through deliberate introduction) then establishment would be possible.

8.8.2 In the case of these three crayfish species, their distribution is incredibly limited in the UK; therefore meaning another introduced population would be of national interest and will need to be closely monitored, to limit the spread.

8.9 Hybrid knotweed and Himalayan knotweed response protocol

8.9.1 There has been very limited success with control and eradication of hybrid knotweed as the species seems to be much more resistant to chemical control. Hybrid knotweed is only present when both parent species (Japanese knotweed and giant knotweed) are present, as it is a hybrid species. Therefore, the primary control mechanism of hybrid knotweed is to swiftly control and treat any occurrences of either parent species to prevent hybridity.

8.9.2 Should the hybrid species be found within the catchment, the species should be controlled firstly through attempting chemical control, similar to Japanese knotweed treatment. Should this fail then treatment should consist of mechanical cutting and burning to prevent too much impact on the surrounding vegetation.

8.9.3 Similarly, there has been limited success in controlling populations of Himalayan knotweed and therefore a similar programme of cutting and treating should be applied to it.

8.10 Parrot's feather response protocol

8.10.1 Parrot's feather is difficult to eradicate, as it is brittle and easily fragmented in manual and mechanical removal, which just increases its spread through vegetative means (RAPID, 2018d). Management through manual and mechanical means is possible, however it can often lead to greater spread through causing dispersal of fragments.

8.10.2 There is currently research into a biocontrol for parrot's feather in the UK, with CABI researching the viability of a leaf-feeding flea beetle (*Lysathia*) which is used in the South African control programme (CABI, 2022). Host-range testing and genetic testing of the UK Parrot's feather population is ongoing.

8.10.3 Should Parrot's feather be found to be present in the catchment, it is likely that the first site of introduction would be either of the nutrient rich and well accessed lakes of Bassenthwaite Lake or Derwentwater. Due to parrot's feather similar ability to spread through vegetative means and similar requirements for successful removal, control should only be considered with the control of *Crassula*, as control of one INNS and not the other when both are present is likely to lead to the other INNS becoming dominant.

8.10.4 Therefore, should parrot's feather be found in the catchment, treatment should mainly consist of enhanced biosecurity protocols and greater communication, with the potential for biocontrols monitored in the future and any treatment carried out alongside *Crassula* treatment if present.

8.11 Zander response protocol

8.11.1 The introductions of zander into the Derwent catchment would only be through intentional introduction. It is likely that a population would not be easily established as the species prefers turbid waters, such as canals. Therefore, should an individual be found (likely during Electrofishing surveys) then the EA should be immediately contacted for further instruction.

8.12 Giant rhubarb Response Protocol

8.12.1 Giant rhubarb variants have not currently been detected in the Derwent catchment, with no known locations to speak of. However, this does not mean it is not present in the region, as it

is likely it has been introduced as an ornamental plant and has just remained undetected for some time.

8.12.2 Giant rhubarb should be treated in a similar way to ASC and JK, see sections 6.3 and 6.4. The source point of giant rhubarb should be determined before beginning treatment and treatment should begin from this point down.

8.12.3 Treatment should firstly consist of removing all flower heads prior to seeding, to prevent adding to the seedbank (North Harris Trust, 2023). Herbicide (glyphosate) should be applied to the plants in autumn, to target the rhizomes as the plant draws down the nutrients for the winter. Treatment should be maintained across multiple years, as rhizomes in the soil are unlikely to be killed in one treatment year and a seedbank is likely to be present for multiple years following this (Armstrong *et al.*, 2009).

9 Resources

9.1.1 This strategy has outlined multiple ways in which partners are currently working to mitigate the impact of INNS across the Derwent catchment but has also outline areas for improvement and the mechanisms for that. It has been implied that resources and funding are limited to this purpose.

9.1.2 WCRT employ a full-time INNS Project Officer whose main role is INNS management and mitigation, with the majority of their time focused on the Derwent catchment. The Derwent INNS project in its current form began in 2022 (hence the inception of this strategy) and has relied on short term, small funding bids and a multi-year FiPL funding bid for staff-time on biosecurity and management projects in the Cocker catchment. These funding bids have concentrated on funding staff time to continue Himalayan balsam, Japanese knotweed and American skunk cabbage control across the catchment with an emphasis on volunteer time. The funding has been directly spent on staff time, overheads and small equipment purchases. Funding for this purpose is key to continue the project; however, to ensure longevity we have identified potential resources shortcomings:

- Multiyear funding to develop community ran HB bashing
- Multiyear staff time funding to oversee multiple INNS projects
- Short-term, high impact funding for projects such as HB rust fungus, biosecurity training, educational materials inception. Projects such as these would require initial investment followed by monitoring time or staff time for the following years but require initial investment to begin the project.

9.1.3 WCRT have a substantial volunteer base with 400 signed up to their mailing list and over 90 regular volunteers registered on the volunteer system. In 2022, 58 individual volunteers donated 990 hours of their time to helping manage and survey for INNS. This is a huge resource for WCRT as their input ensures continued management of INNS, and means they have a loyal volunteer base to use. Whilst these volunteers are a fantastic resource for the INNS project, currently all INNS volunteer opportunities rely upon a member of staff to be present, as not all groups feel comfortable going out on their own. As per this strategy, WCRT will be putting more emphasis on setting up groups as individually run entities.

9.1.4 The NT have ten members of staff, with INNS incorporated into their role in some way, with a target of five days each of INNS management a year. The NT also do not currently have a designated INNS budget, with any funds required currently taken from the countryside operational budget. Additionally, there is no current INNS volunteer base used by the NT. To ensure the longevity of the INNS project we have identified the following potential resources shortcomings:

- An INNS budget for management projects to be undertaken across multiple years (e.g. Crassula control projects), as well as short term high impact funding opportunities such as those mentioned above for WCRT.
- A volunteer programme for multiple INNS control on NT land, with the aim to set up self-sustaining groups.

9.1.5 Both organisations require funding for short-term, high impact projects such as HB Rust Fungus and volunteer programmes. Projects such as these would require initial investment followed by monitoring time or staff time for the following years but require initial investment to begin the project. These projects are likely to involve funding bids of £5000-£20000, to cover materials and staff time in one year. In contrast, both organisations are in need of multi-year

funding for projects such as *Crassula* control for the NT and continual funding for staff time for WCRT. These bids will need to be >£20000 and across multiple years.

9.1.6 NT aim to develop their INNS volunteer programme over the next couple of years, to develop a sustainable group of INNS trained volunteers to work across their properties. This will help to achieve consistent treatment of INNS across their properties and in line with this strategy.

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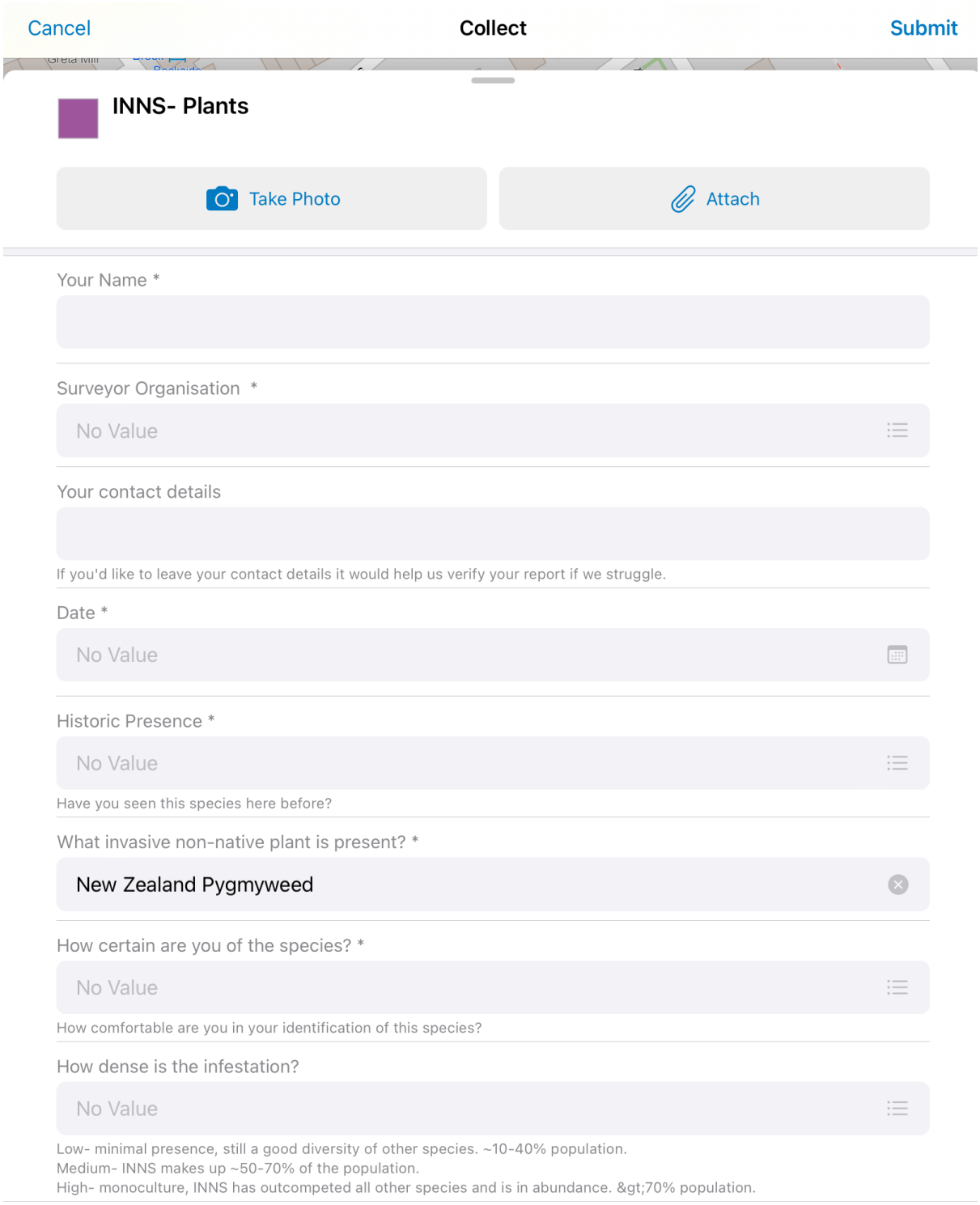
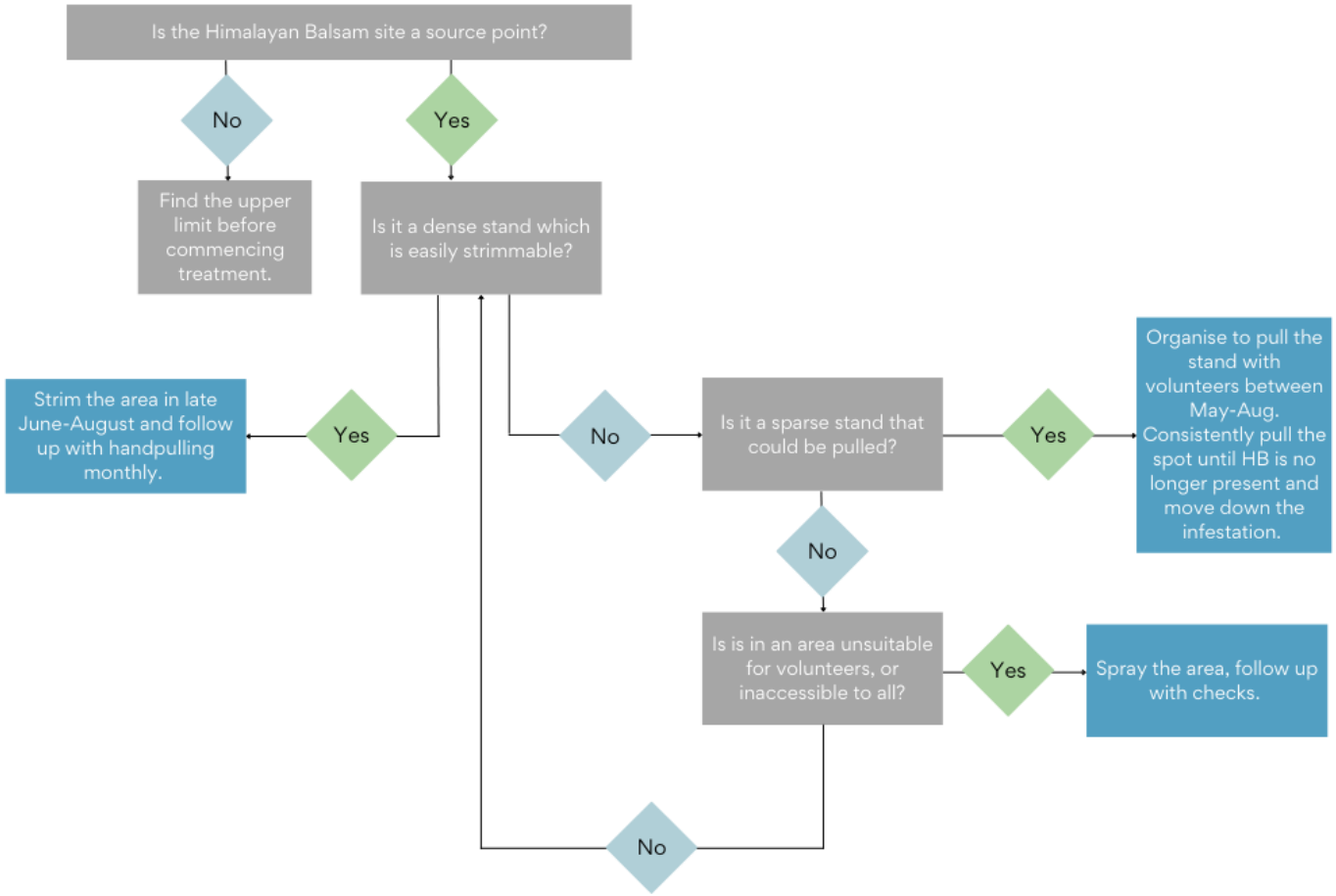
11 Appendix

Appendix 1 *a key to show what colour ratings of the INNS in the Derwent catchment mean, versus the North RIMP colour definitions.*

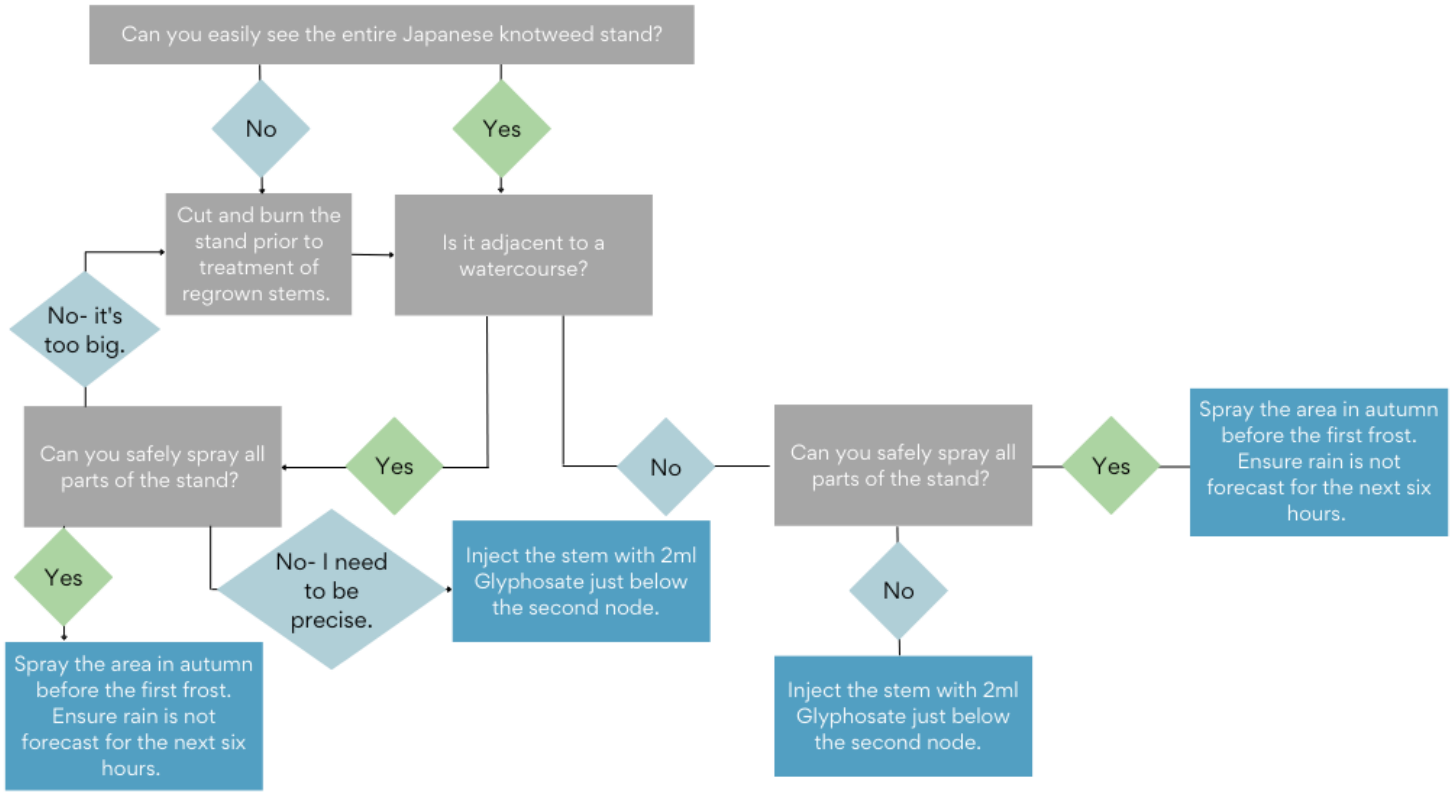
Colour	RAPID North RIMP rating	Derwent catchment rating
	INNS not present in the region, but potentially on their way. High-level threats that should be prevented from being introduced, spread or established within the region.	INNS is not currently present in the catchment. It could quickly spread throughout the catchment or cause irreversible ecological damage. Presence should be dealt with swiftly and action plan should be easily rolled out, with government bodies involved.
	High impact and present in some regions, but not well established or abundant. It may be cost effective to seek eradication (where effective control methods exist) before becomes established.	INNS is not currently present but swift action would ensure eradication and therefore should be easily dealt with. INNS is present in the catchment and causing widespread changes but the ability to eradicate/control is low so containment is the priority.
	Medium priority. Well established species for which eradication is not currently feasible, but control is important due to impact.	INNS is widespread and control is required/should be maintained. INNS is not currently present in the catchment and likelihood of introduction is low.
	Low priority. Species are well stablished and eradication is not currently feasible and management is not a priority due to low impact or cost effectiveness of control is poor.	Very little chance of containing, controlling or eradicating the INNS. The potential damage of the INNS to the catchment is minimal.



Appendix 2 *A screen shot of the Fieldmaps app survey*



Appendix 3 *A decision tree outlining the potential treatment options for Himalayan balsam*



Appendix 4 *A decision tree outlining the potential treatment options for Japanese knotweed*