

# **GREEN GATES PHASE 3 – VEGETATION ESTABLISHMENT STRATEGY**

A report for: Denbighshire County Council

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## Report Validity and Confidentiality

This report aims to provide a vegetation establishment strategy associated with a habitat creation project at Green Gates Phase 3, St Asaph, Denbighshire. This report should be read in conjunction with accompanying reports and drawings produced by Systra associated with the site. The document has been prepared to provide information to Denbighshire County Council.

The report has been prepared by Biodiversity Advanced Ltd in line with the scope of works agreed with the client and in accordance with the specified purpose stated and to the applicable cost, time and other constraints. Works have been carried out in accordance with CIEEM guidelines and BS42020:2013. In preparing this report Biodiversity Advanced Ltd have relied upon information from the client / third parties which was not verified by Biodiversity Advanced Ltd except to the extent required by the scope of services, and Biodiversity Advanced Ltd does not accept responsibility for any omissions or inaccuracies in this information. Where field data has been collected as part of this report, the assessment is based on the data collected during the site visit. Biodiversity Advanced Ltd accepts no responsibility for any changes subsequent to its date of collection.

This report has been prepared solely for the use by, and is confidential to the client and Biodiversity Advanced Ltd accepts no responsibility for its use by other persons. This report does not constitute legal advice. The ecological information presented in this report is valid for a period of 24 months from the date of issue.

## Author Profiles

This report has been produced by Dr Philip Fermor CEnv MCIEEM (Director, Biodiversity Advanced Ltd), Dr Katy Read CEcol CEnv MCIEEM DipSM (Director, Biodiversity Advanced Ltd) and Dr Lynn Besenyei (botanical specialist).

**Dr Philip Fermor** is a highly qualified and enthusiastic habitat creation specialist with 30 years experience in the design and delivery of high-quality habitat restoration, rehabilitation and creation schemes throughout England and Wales. With a PhD in ecological engineering related to the creation of wetland habitats within former industrial land, Phil has extensive experience leading client teams towards biodiversity-positive outcomes, ensuring that costs are balanced with sustainable large-scale biodiversity gain opportunities. As a full member of CIEEM, a Chartered Environmentalist (CEnv) and a member of the British Hydrological Society, Phil promotes sustainable habitat design through the application of a detailed understanding of site-specific requirements (sediments, topography, hydrology, and existing biodiversity features) and local biodiversity strategies. His proven ability to work closely with commercial and corporate clients, third-sector organisations and government bodies, as well as having an in-depth understanding of business-needs and the science of the natural environment, is key to delivering successful biodiversity net gains.

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**Dr Lynn Besenyei** is a botanical specialist, with considerable experience working with ecological consultancies to survey and assess habitat condition within a range of habitats. Lynn's PhD research was focused on grassland creation and management within urban areas. She is an experienced field botanist, holding a BSc Joint Honours in Botany / Zoology from University of Wales. She has a particular specialism in grassland and wetland habitats and has worked with Dr Fermor (Director, Biodiversity Advanced Ltd) for the last 30 years, supporting him with botanical survey skills across a number of sites in England and Wales. Lynn worked as a Senior Lecturer within the School of Sciences at Wolverhampton University, teaching on BSc Animal Behaviour & Wildlife Conservation and MSc Wildlife Conservation. Her research and teaching had a particular focus in habitat management and the role played by plants and animals in different ecological communities.

## Report Issue Record

Report Reference and Issue	Date	Author	Checked By
R-BA194-03	28-06-2024	Dr Katy Read CEcol CEnv MCIEEM DipSM	Dr Philip Fermor CEnv MCIEEM

## EXECUTIVE SUMMARY

This report has been produced by Biodiversity Advanced Ltd for Denbighshire County Council and provides a Vegetation Establishment Strategy associated with a proposed habitat creation project at part of the Green Gates, St Asaph, Denbighshire site known as Phase 3. The report has been produced to provide the project team with information regarding the vegetation establishment options available for the site, given the project's timescales and other opportunities and constraints.

The proposed habitats at Green Gates Phase 3 are shown on Systra 'Proposed Layout' drawings for Areas 1a, 1b, 1c and North Field which have been used to inform this report. The proposed habitats include species-rich grassland, wet (marshy) grassland, fen-type habitat, reedbed, ponds, carr woodland and terrestrial woodland.

A series of vegetation establishment techniques were identified as being potentially appropriate for the site, and the opportunities and constraints of each of these has been considered separately in this report. Natural regeneration will not be used for this project due to the lack of existing vegetation resource at the site and the desire to rapidly establish habitats and achieve funding deadlines.

Commercially available seed was reviewed through correspondence with seed suppliers to consider the potentially suitable seed mixes which could be available for use in this project. Three commercial seed suppliers (Emorsgate Seeds, Hurrells Seeds and Wild Wales Seeds) confirmed that they would be able to supply seed mixtures for the species-rich grassland and wet (marshy) grassland habitats and the pond edge mixtures. Seed sowing can be completed in spring 2025 once earthwork activities have been finished.

The use of plug plants has been recommended to create the reedbed and fen-type habitats areas and to establish the vegetation in the pond habitats. In order to achieve the timescales associated with the funding, it is recommended that plug plants are ordered from commercial suppliers by September 2024 at the latest, and that they are planted in spring 2025. For fen species, DCC may wish to grow the plants themselves, which would require identification of a seed donor site and collection of seeds in summer 2024.

Two different types of woodland are proposed to be established within the Phase 3 land: terrestrial woodland in Areas 1a, 1c and North Field which will be established on the areas where material from the habitat creation works is deposited; and, carr woodland which will form part of the wetland / terrestrial habitat mosaic created at the site. The woodland planting mix for the terrestrial woodland is recommended to be the same as that used for the Green Gates East Nature Reserve project (to be informed by DCC). A proposed planting mix for the carr woodland habitats is provided which includes native black poplar, understood to be currently being grown from local provenance sources at the Denbighshire Tree Nursery.

Using the data collected during the assessment works outlined above, a vegetation establishment matrix has been provided which details the potential establishment techniques which could be used at the site at Green Gates Phase 3 to establish the target habitats.

A biosecurity risk assessment is provided to ensure that potential biosecurity risks associated with vegetation establishment works are identified, considered and risk management control measures are in place.

Habitat management prescriptions have been provided in the accompanying Habitat Management Plan (see report R-BA197-01) for the proposed habitats to ensure that the biodiversity potential of the habitats is maximised.

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## 1. INTRODUCTION

### 1.1 PROJECT INTRODUCTION

- 1.1 This report has been produced by Biodiversity Advanced Ltd for Denbighshire County Council (DCC) and provides a vegetation establishment strategy associated with habitat restoration and creation works at a site known as Green Gates Phase 3, St Asaph, Denbighshire. This report should be read in conjunction with an accompanying Systra report and drawings which set out the proposed habitat creation designs.
- 1.2 The study area at Green Gates Phase 3 comprises the western part of the former Green Gates Farm, a site which is owned by Denbighshire County Council. The farm now includes the recently established Denbighshire Tree Nursery, and it is understood that a new nature reserve is proposed for the eastern part of the site, which will support new woodland, scrub, ponds and species-rich grassland habitats. Habitat creation proposals for the western (Phase 3) part of the site include the restoration of existing ponds, the creation of new ponds, the creation of a wetland area adjacent to two small watercourses and creation of woodland and grassland habitat areas.
- 1.3 The site is located at national grid reference SJ 019 744 with the city of St Asaph to the east and St Asaph Business Park to the immediate west and south of the study area. The A55 is located along the northern boundary of the site. The Phase 3 land is c.15ha in size and comprises three large fields with associated field boundaries, watercourses and ponds.
- 1.4 The area in which the Green Gates site sits is known to support a number of great crested newt populations, both within existing and created ponds. To the immediate west of the Green Gates Phase 3 land is St Asaph Business Park which contains a series of retained and created ponds for great crested newts, with Glascoed Nature Reserve located immediately west of the Business Park. Across these two areas, great crested newt populations fluctuate from medium – large sized populations. Biodiversity Advanced Ltd have produced two supporting reports ‘Green Gates Phase 3 – Great Crested Newt European Protected Species Licence Application: Method Statement’ (ref: R-BA194-01) and ‘Green Gates Phase 3 – Ecological Protection Plan’ (ref: R-BA194-02) which detail ecological protection strategies associated with the project.
- 1.5 Biodiversity Advanced Ltd and Systra have worked as co-consultants on a number of projects at Green Gates. The reports and drawings detailed in Table 1.1 have been produced by the project team and are relevant to the Phase 3 proposals.

Title	Organisation	Reference	Date
Green Gates Phase 3, St Asaph, Denbighshire – Preliminary Ecological Appraisal	Biodiversity Advanced Ltd	R-BA188-01	December 2023
Green Gates Phase 3 – Great Crested Newt European Protected Species Licence Application: Method Statement	Biodiversity Advanced Ltd	R-BA194-01	June 2024
Green Gates Phase 3 – Ecological Protection Plan	Biodiversity Advanced Ltd	R-BA194-02	June 2024
Green Gates Phase 3 – Vegetation Establishment Strategy	Biodiversity Advanced Ltd	R-BA914-03	June 2024
Green Gates Phase 3 – Habitat Management Plan	Biodiversity Advanced Ltd	R-BA917-01	June 2024
Systra Design Drawings ‘Proposed Layout – Area 1a’ ‘Proposed Layout – Area 1b’, ‘Proposed Layout – Area 1c’ and Proposed Layout - North Field’.	Systra Ltd	23C33-DWG-12 23C33-DWG-13 23C33-DWG-14 23C33-DWG-15	June 2024

**Table 1.1: Relevant Documents Produced by Project Team for Green Gates Phase 3**

- 1.6 In addition to the habitat creation works at Phase 3, it is proposed that a Biodiversity Hub building be constructed to provide an educational facility and centre of use by DCC's Biodiversity Team. Access to this building will be provided by a boardwalk / all abilities access route. As it is understood that this building will be a self-contained feature, no vegetation establishment details are proposed as part of this element of the project (it is not known whether it will be possible to create a green roof for example on the building).

## 1.2 SITE INTRODUCTION

- 1.7 The site at Green Gates Phase 3 is owned and managed by Denbighshire County Council (DCC). The Phase 3 land is allocated in the adopted Denbighshire Local Development Plan 2006-2021<sup>1</sup> under PSE2 Land for employment uses. However, it is understood from DCC that subsequent to this land allocation, the area has had a number of significant overhead and underground services installed across it, making it un-viable for development for employment use.
- 1.8 Denbighshire County Council are currently working on a replacement Local Development Plan 2018 - 2033, with the plan currently at 'Deposit Consultation and consideration of representations' stage between September 2023 and May 2024<sup>2</sup>. The LDP is proposed to be submitted for Examination in May 2024. This replacement LDP has not yet been adopted, and as such does not form a material consideration in planning matters.
- 1.9 The site at Green Gates was formerly tenanted out and used as a farm, predominately for horse grazing. An area to the south of the former farm building has been established as Denbighshire Tree Nursery, with tree growing areas, polytunnels, and associated equipment storage and facilities. Three small ponds were built in 2021 and form part of the Tree Nursery's Sustainable Drainage System (SuDS), taking excess water from the polytunnels before outfalling in the watercourse which flow in the northerly direction to the east of the Tree Nursery.
- 1.10 The proposed habitat creation works at the site are detailed in Section 2 and are scheduled to be completed by March 2025.
- 1.11 With respect to public access to the site at Green Gates, a bridleway exists outside of the Phase 3 site boundary immediately to the west. This access route runs north-south between the Green Gates site at the St Asaph Business Park and connects to a public footpath that then extends to the west towards Glascoed Nature Reserve which exists to the west of the Business Park.
- 1.12 There is currently no public access onto the site at Green Gates. Within the eastern part of the site, proposed to be a nature reserve, permitted footpaths are proposed to allow members of the public to access these areas for walking and educational purposes. No public access is proposed within the Phase 3. It is understood that use of the Biodiversity Hub will be through organised visits with DCC staff.

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<sup>1</sup> Available at: <https://www.denbighshire.gov.uk/en/planning-and-building-regulations/local-development-plan/adopted-local-development-plan.aspx>

<sup>2</sup> See: <https://www.denbighshire.gov.uk/en/documents/planning-and-building-regulations/ldp/replacement-ldp/denbighshire-replacement-ldp-2018-to2033-revised-delivery-agreement-december-2022a.pdf>

## 2. HABITAT PROPOSALS

### 2.1 INTRODUCTION

2.1 This chapter of the report provides outline information associated with the proposed habitats to be established at the Green Gates Phase 3 site. Detailed designs for the proposed habitat creation works are provided on the following Systra drawings which should be viewed in conjunction with this report:

- ◆ Proposed Layout - Field 1A. Dwg Ref: 23C33-DWG-12. Revision: P01
- ◆ Proposed Layout - Field North. Dwg Ref: 23C33-DWG-13. Revision: P01
- ◆ Proposed Layout - Field 1B. Dwg Ref: 23C33-DWG-14. Revision: P01
- ◆ Proposed Layout - Field 1C. Dwg Ref: 23C33-DWG-15. Revision: P01

### 2.2 HABITATS

2.2 The proposed habitat layout for the site is shown on Systra drawings detailed above. These drawings have been developed using the data collected as part of the feasibility and detailed design phases of this project. The drawing has been reviewed by the Biodiversity Team at DCC and includes input from DCC and other stakeholders during the detailed design phase.

2.3 The proposed habitat areas were calculated by Systra based on the Systra 'Proposed Layout' drawings (see above). The habitat areas are detailed in Table 2.1. These areas are presented on a field by field basis. The field references are shown on the Systra drawings. The data presented in Table 2.1 has also been used in the accompanying 'Ecological Protection Plan' and 'Great Crested Newt EPS Licence Method Statement' reports (see Table 1.1).

2.4 The proposed habitat creation works at the site will be completed using hydraulic excavators and will involve reduced level excavation and deposition of excavated material above ground.

2.5 The areas where material is proposed to be deposited will be used for creation of woodland and scrub habitats and other features. Additional areas of woodland and scrub habitats are also proposed to be created where material deposition is not required. DCC have a target to achieve 20% cover of woodland and scrub on their sites across the county, and this target has been taken into account as part of the detailed design of the scheme shown on the Systra 'Proposed Layout' drawings detailed above.

2.6 The proposed works at the site will include:

- ◆ Restoration of 2 no. existing ponds (GG4 and GG6), one of which is known to be used by great crested newts.
- ◆ Creation of 6 no. new ponds (GG7, GG8, GG9, GG10, GG11, GG13) through reduced level excavation. It is noted that GG9 will be a large pond as it will not only provided habitat for amphibians, but will also provide a focal point for the new Biodiversity Hub building which will overlook this area of open water.
- ◆ Creation of an area of wetland habitat (shown as GG12) at the confluence of two small watercourses (to include marginal / emergent wetland vegetation, fen and wet grassland) through reduced level excavation.
- ◆ Diversion of a small watercourse to provide a hydrological connection to GG9.
- ◆ Deposition of excavated material to create landscape bunds and planting of 3.25 ha of broadleaved woodland habitat.
- ◆ Installation of 8 no. hibernacula suitable for use by amphibians and reptiles.



- ◆ Installation of a 'Biodiversity Hub' building to be used by Denbighshire County Council for educational purposes.
- ◆ Installation of an accessible access route to the 'Biodiversity Hub' building.

2.7 Table 2.1 details the areas associated with the habitat retention, restoration and creation proposals.

Habitats	Habitat / Feature Area (m <sup>2</sup> )					
	Tree Nursery	Area 1a	Area 1b	Area 1c	North Field	TOTAL
<b>Retained Habitats</b>						
Pond GG1	30	-	-	-	-	<b>30</b>
Pond GG2	30	-	-	-	-	<b>30</b>
Pond GG3	40	-	-	-	-	<b>40</b>
Pond GG5	-	283	-	-	-	<b>283</b>
Existing grassland	-	22,868	20,521	21,276	23,356	<b>88,218</b>
Tall ruderal	-	-	-	3,552	-	<b>3,552</b>
Existing trees	-	-	-	1,380	-	<b>1,380</b>
<b>Proposed Habitats</b>						
Open water	-	1,827	545	805	-	<b>3,040</b>
Pond edge plants	-	1,374	150	184	-	<b>1,648</b>
Reedbed	-	1,374	150	-	-	<b>1,524</b>
Fen	-	3,210	75	-	-	<b>3,284</b>
Willow carr	-	3,210	75	-	-	<b>3,284</b>
Marshy grassland	-	2,064	76	256	-	<b>2,396</b>
Species-rich grassland	-	5,989	-	-	-	<b>5,989</b>
Woodland	-	5,126	-	5,115	22,280	<b>32,521</b>
Biodiversity Hub	-	249	-	-	-	<b>249</b>
<b>TOTAL (m<sup>2</sup>)</b>	<b>100</b>	<b>47,573</b>	<b>21,591</b>	<b>32,568</b>	<b>45,636</b>	<b>147,468</b>

**Table 2.1: Summary of Proposed Habitat Areas at Green Gates Phase 3**

### 2.3 VEGETATION ESTABLISHMENT TECHNIQUES

2.8 A discussion, based on desk study research, related to the different water level requirements for target habitats and vegetation establishment techniques which can be used is given in the 'Green Gates Phase 3 – Wetland Feasibility and Initial Design (Ecology)' report (ref: R-BA189-01) and is not therefore repeated in this report.

2.9 For given habitats at different sites, with different drivers and timescales, one establishment technique may be more appropriate than others and this report defines the strategy which has been chosen for the habitat restoration and creation project at Green Gates Phase 3.

2.10 In general, there are five different vegetation establishment techniques which can be adopted:

- ◆ Natural regeneration – where vegetation is allowed to establish naturally from an existing seedbank, or expansion of existing habitats.
- ◆ Translocation from an existing resource – where turves or rhizome / seed rich topsoil is used to establish new habitats.
- ◆ Green hay - where green hay from an existing established habitat is used and strewn over the target habitat area, allowing seed to fall and establish.

- ◆ Seeding – this could involve using a seed mix either from a commercial supplier or collected from another established habitat site, which is sown to create the new habitat.
- ◆ Direct planting – where plants are directly planted into the new habitat. This could include plug planting, or tree planting for example.

2.11 During project meetings with DCC, held during the feasibility and design stages of the project, the use of different establishment techniques was discussed and it was confirmed (Walley, 2024, *Pers. Comm.*) that for this site, given the current habitats present, the availability of plant material and team resources from the established Tree Nursery on site, and the funding requirements for the project, DCC do not wish to use extensive natural regeneration as an establishment technique at the site, although they recognise the value of this approach, and that it may be appropriate in smaller, targeted habitat areas.

2.12 A matrix of the potential establishment options and the opportunities and constraints associated with each of these (specific to the Green Gates site), was developed and is included in Table 2.2.

Habitat	Natural Regeneration	Translocation - donor turves / rhizomes	Green Hay	Local Seed Mix	Commercial Seed Mix	Direct Planting - whips / plugs
Floating / aquatic vegetation in shallow channels	No onsite resource available. Expansion from existing offsite resource potentially limited. Potentially limited species diversity. Significant time required to establish vegetation. Local provenance. Takes time.	Very minimal onsite resource available, which would be damaged at donor ditches. Expensive transportation costs if not on site.	n/a	Use of 'seed bombs' from local species-rich ditches. No local resource known at this stage. Possibly minimal opportunity from other DCC-owned sites.	Potential if seed mix available and water levels allow establishment.	Possible given small areas of shallow channels to be created. Potentially a more expensive option.
Floating / aquatic vegetation in ponds	Potential seed dispersal from nearby ponds. Risk of limited species diversity. Takes time. Onsite resource has low species diversity.	Possible, although may cause damage to donor ponds. Expensive transportation costs.	n/a	Use of 'seed bombs' from local species-rich ponds if agreement with landowners could be made e.g. Glascoed NR, St Asaph Business Park. Would require pond water levels to be optimal. Timing?	Pond plant seed mixes commercially available. Sowing possible only once pond water levels are established. Timing?	Pond plugs commercially available. Plant 10-30% of area with 35ml plugs @ 9 plugs/m <sup>2</sup> . Potentially a more expensive option. Fencing required.
Reedbed	Small areas to establish, but no resource already on site. Natural regeneration not considered viable option.	Small areas to establish, but no resource already on site. Natural regeneration not considered viable option.	n/a	n/a - common reed seed known to not germinate well in UK.	n/a - common reed seed known to not germinate well in UK.	Common reed plug planting possible. Plant between 4-8 plugs/m <sup>2</sup> . An expensive but effective option. Fencing required. Would require reed to be already growing at nursery for 2025 planting or purchase from external source.

**Table 2.2: Green Gates Phase 3 Vegetation Establishment Matrix** (continues)

Habitat	Natural Regeneration	Translocation - donor turves / rhizomes	Green Hay	Local Seed Mix	Commercial Seed Mix	Direct Planting - whips / plugs
Fen-Type Habitat	Unlikely to be feasible due to lack of existing resource.	Unlikely to be feasible due to lack of existing resource.	Green hay strewing from suitable local source. No local resource currently known. Consideration of timing issues given funding restrictions. Potential nutrient management issues.	Collection of seed from local source. Seed collection potentially more challenging than green hay. Potential nutrient management issues.	Commercial seed mix for fen habitats unlikely to be readily available for sowing.	Relatively small areas of habitat to establish, potentially possible from plug plants if they can be sourced from commercial nursery, or grown within Onsite nursery.
Marshy grassland	Unlikely to be successful due to lack of existing marshy grassland resource at the site.	Lack of resource for translocation onsite. Not usual establishment method for grassland habitats.	Green hay strewing from suitable local marshy grassland source. No resource known. Timing considerations due to funding restrictions for habitat creation. Potential nutrient management issues.	Collection of seed from local source. Seed collection potentially more challenging than green hay. Potential nutrient management issues.	Use of commercially available marshy grassland seed mix (species may be limited). Must be appropriate for sediments. Potential nutrient management issues.	Not usual establishment method for grassland habitats. NOTE - may be used for individual target species once grassland is established, if required.
Species-rich grassland	Some concern re nutrient levels in areas targeted for species-rich grassland where topsoil will not be removed. No resource currently available at site.	Not usual establishment method for grassland habitats.	Green hay strewing from suitable local marshy grassland source. No resource known. Timing considerations due to funding restrictions for habitat creation. Potential nutrient management issues.	Collection of seed from local source. Seed collection potentially more challenging than green hay. Potential nutrient management issues.	Use of commercially available marshy grassland seed mix (species may be limited). Must be appropriate for sediments. Potential nutrient management issues.	Not usual establishment method for grassland habitats. NOTE - may be used for individual target species once grassland is established, if required.

**Table 2.2: Green Gates Phase 3 Vegetation Establishment Matrix** (continues)

Habitat	Natural Regeneration	Translocation - donor turves / rhizomes	Green Hay	Local Seed Mix	Commercial Seed Mix	Direct Planting - whips / plugs
Woodland and scrub	Natural regeneration is viable woodland creation technique. Requires a long time and suitable local seed material.	n/a	n/a	n/a	Seed mixes may be used to establish woodland ground flora once tree canopy is established. Unlikely to be achievable during project timescales.	Establish main woodland species (canopy and understory) using planting of whips grown at Tree Nursery site. Excellent local provenance resource. May be limited by species already growing at Tree Nursery.

**Table 2.2 (continued): Green Gates Phase 3 Vegetation Establishment Matrix**

	Negative / warning / potential 'show stopper'
	Neutral / needs further investigation
	Positive / ideal establishment strategy / benefit to donor site

## 2.4 GREEN GATES VEGETATION ESTABLISHMENT APPROACH DECISIONS

- 2.13 This vegetation establishment matrix has been discussed with the project team throughout the feasibility and design stages of this projects and the following design decisions were made by the project client team.
- 2.14 Given the lack of on-site wetland vegetation resource (other than a few species found within the three ponds at the Tree Nursery which are understood to have established through natural regeneration), the use of natural regeneration as an establishment method is not considered likely to be very successful in creating extensive, species-rich habitats.
- 2.15 The funding requirements for the habitat creation and vegetation establishment works mean that all works should be completed by March 2025. This means that using green hay as a vegetation establishment technique may not be appropriate for this site due to the need to complete the habitat works by March 2025 in line with the project's funding. Establishment of fen, wet grassland and species-rich grassland habitats using green hay would require sourcing of a suitable donor site accessible from the site at Green Gates (due to transportation costs) and then strewing of green hay material in August 2025. Clearly this is beyond the timescale for the current project funding, and as such has not been chosen as a primary habitat establishment method.
- 2.16 The collection of locally harvested fen and grassland seed is another option which has been considered as part of the establishment options appraisal. However, this option again requires the use of resources which are not currently available to DCC as part of their funding arrangement and as this would require the identification of donor sites, botanical surveys of these sites, agreement with the site landowners regarding use of the donor material and specialist collection, sorting and storage of seed mixes from the donor sites. This option is not therefore pursued in this strategy.
- 2.17 The site currently does not support any wetland habitats with the exception of some vegetation within the existing ponds at the Tree Nursery. The vegetation in these ponds is limited in extent and species diversity, and use of these vegetation for translocation would result in damage to the existing, establishing pond habitats, some of which are know to be used by great crested newts. Turf / rhizome translocation was therefore not considered further in this strategy.
- 2.18 As set out in Section 1.1, the land within the eastern part of the Green Gates site is proposed to be used for the creation of a nature reserve, with amphibian ponds, species-rich grassland, woodland, hedgerow and scrub habitats all represented within the site. The habitats within the eastern part of the site will be established using a mixture of seeding of grassland areas, and direct planting within the woodland / scrub and pond habitats. Discussions with the project team have agreed that a similar approach would be appropriate to adopt within the Phase 3 land at Green Gates.

## 2.5 NUTRIENT MANAGEMENT

- 2.19 Nutrient limitation is considered to be one of the most important factors affecting the composition of plant communities and where projects aim to restore / create species-rich grassland and fen communities, soil properties, and nutrient status in particular, should be taken into account to ensure selection of a realistic habitat creation goal (Critchley et al, 2002). The residual effects from fertilizer can play an important part in determining the success of schemes to establish floristically-rich vegetation on former agricultural land, although the

quality and quantity of these residues depends on many factors including soil type, history and type of fertilizer used (Marrs, 1993).

- 2.20 McBride et al (2011) state that in order to establish moderately species-rich fen vegetation, nutrient levels should ideally be low, especially phosphate concentrations which should be lower than 15 parts per million (ppm), and ideally below 9 ppm.
- 2.21 It is recognised that the site has been used for pasture for horse grazing prior to the lapse of the farm's tenancy and DCC taking over the management of the site again. It is understood that since 2020, no fertilisers have been used within the grassland habitats at the site, however, these areas may still harbour some residual nutrient inputs from historical fertiliser use. The extent of this nutrient enrichment is not known.
- 2.22 As discussed above, given the restrictions associated with funding for the habitat creation works meaning that vegetation establishment activities have to be completed during one season, opportunities for nutrient management activities at the site may be limited. Walker et al (2004) carried out a review of techniques available for nutrient depletion which identified the following options:
- ◆ Arable cropping;
  - ◆ Hay and silage cropping;
  - ◆ Grazing;
  - ◆ Inversion by ploughing;
  - ◆ Topsoil removal; and,
  - ◆ Use of chemicals and other materials.
- 2.23 The idea of using cropping to reduce nutrient levels comes from the rationale that more nutrients, in particular soil Phosphorus (P) are removed from the soil by the standing crop than are added as inputs. Taking an arable crop continuously (and ideally removing all the above ground material, not just the crop seeds heads) without the addition of fertilisers will therefore eventually reduce the nutrient capital and supply within the soils. The site is not an arable site, and has an established pasture sward and as such this nutrient management technique is not considered to be a viable option for this site.
- 2.24 The use of hay / silage cropping, and removing the arisings, is already established at the site, and grass arisings are currently either removed off site, or stored in a number of grass piles within the Phase 3 land. This approach is understood to potentially result in the long-term reduction of nutrient levels within the habitat.
- 2.25 The idea of using inversion by ploughing originates from the fact that soil nutrients in former arable soils are generally found in the topsoil layers, as they are artificially put onto the soils as part of the farming operation. The inversion of soils using a deep plough (30-40 cms) aims to turn the soils over, thus burying topsoils with a higher nutrient status below sub-soils which may be more nutrient-poor. The operation also buries any existing seedbank which could be beneficial if the seedbank contains undesirable species. However, as discussed above, this is not an arable site, and as such deep ploughing may not be achievable at the site. This nutrient management option is not therefore considered appropriate.
- 2.26 The removal of topsoil is another nutrient reduction technique, involving the excavation of soils and transportation of these soils (either within the site, or off-site). Within those areas where earthworks are required to generate the necessary ground levels and microtopography associated with the creation of target wetland habitats, this option would be adopted to some extent and excess topsoil materials would be targeted for deposition within the areas where

trees would be planted. A thin layer of topsoil would be replaced within the species-rich / marshy grassland and wetland habitat areas given the clay sediments at the site, in order to provide a shallow establishment medium for these habitats. The removal of greater depths of topsoil from the proposed habitat areas are therefore considered to potentially reduce the levels of residual nutrients from these parts of the site, assisting with the establishment of habitats which thrive in lower nutrient conditions.

- 2.27 The application of appropriate chemical materials that adsorbs available nutrients could be a successful, albeit potentially toxic method for reducing soil fertility (Walker et al, 2004). Due to the potentially toxic side effects, and the presence of protected species at the site, including great crested newts and reptiles, such treatments are considered unacceptable for adoption at this site.



### **3. GRASSLAND**

#### **3.1 INTRODUCTION**

- 3.1 This chapter of the vegetation establishment strategy considers the proposed establishment of marshy grassland and species-rich grassland habitats from available commercial seed providers.
- 3.2 Török et al (2011) state that the seeds used in grassland restoration (or creation projects) can be purchased from commercial sources or collected by local harvesting. They suggest that commercial sources are appropriate if the seeds can be sourced from local populations of the target species, however, seeds which are harvested locally specifically for a project is preferable. Sowing seeds from local sources decreases the chances of restoration failure due to the genetic incompatibility of the sown and naturally colonising individuals of a species. Using local ecotypes also increases the chances of restoration success as such ecotypes are better adapted to the local environmental conditions and may be better competitors against local weeds.
- 3.3 Török et al (2011) suggest that local seeds can be collected by hand or by appropriate equipment (e.g. vacuum harvester, or combine harvester). They identify that although hand collection is time consuming and can be costly, it is important when target species are located in scattered populations.
- 3.4 Information is presented in this Chapter from discussions with potential suppliers associated with the use of grassland seed mixes.
- 3.5 Consultation with seed suppliers was completed in May – June 2024.

#### **3.2 SEED MIXTURE INVESTIGATIONS**

- 3.6 Initial correspondence was entered into with a number of potential seed suppliers including:
- ◆ Bortons Ltd;
  - ◆ Emorsgate Seeds;
  - ◆ Hurrells; and,
  - ◆ Wild Wales Seeds.
- 3.7 Potential seed suppliers were provided with high-level information associated with the project at Green Gates Phase 3, and initial target habitat types and potential habitat creation areas.
- 3.8 A summary of the initial responses provided by the seed suppliers is given in Table 3.1.

Supplier	Summary of Initial Discussions
<b>Commercial Seed Suppliers</b>	
<p>Bortons Ltd The Mowhay, Leeches Farm, St. Kew Highway, Bodmin, Cornwall, PL30 3EG</p> <p>Stephen Webster 07984 666415 01208 863948</p>	<p>Bortons Ltd is a seed agency for Hurrells Seeds. They can bespoke mix anything that the project needs. Normally they would work on 2-3 working days for delivery.</p> <p>Further information provided in the Hurrells Seeds row below.</p>
<p>Emorsgate Seeds Neeps Bridge Farm Middle Drove Wisbech, Cambs., PE14 8JT</p> <p>Mark Schofield 01553 829028</p>	<p>Emorsgate Seeds produce wild seeds for ecological restoration and the rejuvenation of nature. The seed production encompasses approximately 800 acres of land, with half dedicated to single-species crops and the rest including woodlands and meadows for responsible seed harvesting. Emorsgate Seeds can guarantee all of the seed that they supply is of wild origin seed, and is completely wild.</p> <p>Emorsgate seeds come with guaranteed genetic variation, ensuring adaptability to changing environments and climates.</p> <p>Three species mixes could be appropriate for use in the Green Gates Phase 3 project:</p> <ul style="list-style-type: none"> <li>◆ Meadow mixture for clay soils (EM4).</li> <li>◆ Pond edge mixture (EP1).</li> <li>◆ Meadow mixture for wetlands (EM8).</li> </ul> <p>In addition, Emorsgate seeds can provide quantities of individual seeds, sold by weight with any quantity ordered (when they are in stock) which include seeds for wild grasses, sedges and rushes. These seeds are identified to their county of origin and are wild types, with a high level of genetic variation within each species.</p>
<p>Hurrells Seeds Beverley Road, Cranswick, East Yorkshire, YO25 9PF</p> <p>Dan Gladstone 01377 271400</p>	<p>Hurrells Seeds confirmed that they had been involved with numerous projects to supply wildflowers and grassland seed mixes. They have 152 species of British native wildflowers and confirmed that they didn't have any issues with providing the volumes and potential species mixes that were discussed.</p> <p>Gladstone (13 years working with the seed company) suggested two seed mixes (presented below) specifically for the site at Green Gates:</p> <ul style="list-style-type: none"> <li>• MG10 seed mix. Cost £49 PER KG DEL + VAT (30-40KG PER HA RECOMMENDED).</li> <li>• Dry grassland mix for heavier ground. Cost £48 PER KG DEL + VAT (30-40KG PER HA RECOMMENDED)</li> </ul> <p>For the dry grassland mix, Gladstone suggested that all the grasses will do well on the dry areas. To adapt on very heavy soils, it would be possible to add in Meadow Fescue, Dwarf Tall Fescue and other items that will do better in the clay, however, these may be too competitive for the flowers.</p> <p>If any annual wildflowers are required these could also be supplied.</p> <p>Hurrells do not hold any local provenance seed mixes from within 10 miles of the site at Green Gates. All UK provenance species.</p>

**Table 3.1: Summary of Initial Consultation with Potential Seed Suppliers** (continues)

Supplier	Summary of Initial Discussions
<b>Commercial Seed Suppliers</b>	
Wild Wales Seeds Blackton Farm Penmark CF62 3BB  Kelly Tel: 029 2021 4695  info@wildwales- seeds.co.uk	Wild Wales Seeds are an agricultural seed supplier based in the Vale of Glamorgan. They supply both agricultural, amenity and wild seed mixes as well as seeds of individual species.  They have two mixes which may be of specific use in this project, both of which include 80% low maintenance grasses for neutral soils and a 20% flora blend: <ul style="list-style-type: none"> <li>• General Purpose Mix</li> <li>• Neutral / Damp Soils Mix</li> <li>• Wetland Pond Edge Mix</li> </ul> They also provided information about the following other see mixes which they consider to be good for all soil types: <ul style="list-style-type: none"> <li>• Native Welsh Countryside Wildflower Mix</li> </ul>

**Table 3.1 (continued): Summary of Initial Consultation with Potential Seed Suppliers**

### Emorsgate Seeds

- 3.9 Emorsgate Seeds 'Meadow Mixture for Clay Soils'<sup>3</sup>, is a mix composed of 20% native wild flowers and 80% slow growing grasses (by weight). Species composition is summarised in Table 3.2. This seed mix could be suitable for use on the dry grassland areas which will be created as part of the scheme.
- 3.10 Their 'Meadow Mixture for Wetlands'<sup>4</sup> mix contains species suitable for seasonally wet soils and is based on the vegetation of traditional floodplain and water meadows. Soils in these habitats may flood for short periods in winter, but are usually well drained in summer. Table 3.3 details the species which are included in this species mix. This seed mixture could be used for the 'marshy grassland' habitats within the proposed habitat layout.
- 3.11 All three of these seed mix should be sown at a rate of 4g / m<sup>2</sup> over the relevant habitat areas (see Table 2.1).
- 3.12 Emorsgate recommend that all of the grassland seeding works should be completed in suitable weather conditions in March / April or late September / October (where there are damp soils but no heavy rain or flooding during the seeding works). The success of the seeding establishment will depend on sowing when there are suitable weather conditions prior to, during and after seed has been sown. Seed should be surface sown and can be applied by machine or broadcast by hand. Seed should not be incorporated or covered, but firmed in with a roll, or by treading, to achieve good soil/seed contact.

<sup>3</sup> See: <https://wildseed.co.uk/product/mixtures/complete-mixtures/meadow-mixtures-for-specific-soils/meadow-mixture-for-clay-soils/>

<sup>4</sup> See: <https://wildseed.co.uk/product/mixtures/complete-mixtures/meadow-mixtures-for-specific-soils/meadow-mixture-for-wetlands/>

Percentage	Common Name	Scientific Name
<b>20% Wild Flowers:</b>		
0.20%	Agrimony	<i>Agrimonia eupatoria</i>
0.20%	Betony	<i>Betonica officinalis</i>
0.10%	Birdsfoot trefoil	<i>Lotus corniculatus</i>
3.00%	Common knapweed	<i>Centurea nigra</i>
0.20%	Cowslip	<i>Primula veris</i>
0.20%	Dandelion	<i>Taraxacum officinale</i>
1.00%	Glaucous sedge	<i>Carex flacca</i>
2.00%	Lady's bedstraw	<i>Galium verum</i>
0.70%	Meadow buttercup	<i>Ranunculus acris</i>
0.50%	Meadow Vetchling	<i>Lathyrus pratensis</i>
0.80%	Meadowsweet	<i>Filipendula ulmaria</i>
2.50%	Musk mallow	<i>Malva moschata</i>
0.80%	Oxeye daisy	<i>Leucanthemum vulgare</i>
0.20%	Pepper saxifrage	<i>Silaum silaus</i>
1.20%	Ragged robin	<i>Silene flos-cuculi</i>
4.10%	Ribwort plantain	<i>Plantago lanceolata</i>
0.30%	Wild carrot	<i>Daucus carota</i>
2.00%	Yarrow	<i>Achillea millefolium</i>
<b>80% Grass Species:</b>		
2.40%	Common bent	<i>Agrostis capillaris</i>
62.40%	Crested dogstail	<i>Cynosurus cristatus</i>
2.00%	Quaking grass (w)	<i>Briza media</i>
10.00%	Red fescue	<i>Festuca rubra</i>
2.00%	Sweet vernal-grass (w)	<i>Anthoxanthum odoratum</i>
1.20%	Yellow oat-grass (w)	<i>Trisetum flavescens</i>

**Table 3.2: Emorsgate Meadow Mixture for Clay Soils** (from Emorsgate Seeds)

Percentage	Common Name	Scientific Name
<b>20% Wild Flowers:</b>		
0.60%	Agrimony	<i>Agrimonia eupatoria</i>
0.10%	Birdsfoot trefoil	<i>Lotus corniculatus</i>
3.60%	Common knapweed	<i>Centurea nigra</i>
1.20%	Common sorrel	<i>Rumex acetosa</i>
0.20%	Cowslip	<i>Primula veris</i>
0.10%	Devil's-bit scabious	<i>Succisa pratensis</i>
1.00%	Great burnet	<i>Sanguisorba officinalis</i>
0.40%	Greater birdsfoot trefoil	<i>Lotus pedunculatus</i>
2.00%	Lady's bedstraw	<i>Galium verum</i>
0.40%	Meadow buttercup	<i>Ranunculus acris</i>
0.50%	Meadow Vetchling	<i>Lathyrus pratensis</i>
1.00%	Meadowsweet	<i>Filipendula ulmaria</i>
1.20%	Oxeye daisy	<i>Leucanthemum vulgare</i>
0.30%	Ragged robin	<i>Silene flos-cuculi</i>
3.20%	Ribwort plantain	<i>Plantago lanceolata</i>
0.10%	Rough hawkbit	<i>Leontodon hispidus</i>
0.10%	Selfheal	<i>Prunella vulgaris</i>
0.40%	Tufted vetch	<i>Vicia cracca</i>
0.20%	Water avens	<i>Geum rivale</i>
2.00%	Yarrow	<i>Achillea millefolium</i>
1.40%	Yellow rattle	<i>Rhinanthus minor</i>
<b>80% Grass Species:</b>		
4.00%	Common bent	<i>Agrostis capillaris</i>
34.40%	Crested dogstail	<i>Cynosurus cristatus</i>
1.60%	Grey sedge (w)	<i>Carex divulsa subsp. divulsa</i>
4.00%	Meadow barley (w)	<i>Hordeum secalinum</i>
20.00%	Red fescue	<i>Festuca rubra</i>
8.00%	Rough-stalked meadow-grass	<i>Poa trivialis</i>
4.00%	Sweet vernal-grass (w)	<i>Anthoxanthum odoratum</i>
1.60%	Tufted hair-grass (w)	<i>Deschampsia cespitosa</i>

**Table 3.3: Emorsgate Meadow Mixture for Wetlands** (from Emorsgate Seeds)

- 3.13 During the first year, Emorsgate state that there will likely be a flush of annual weeds, which should not be cut until mid to late summer (early August for example). The annual weeds should then be cut, removed and composted. The young grassland areas can then be kept short by mowing through to the end of March the following year. Any residual perennial weeds such as docks will need to be dug out.
- 3.14 Emorsgate Seeds recommend that the best long-term results are usually obtained by traditional meadow management based around a main summer hay cut in combination with autumn and possibly spring mowing or grazing. Meadow grassland should not be cut or grazed from spring through to late July / August to give the sown species an opportunity to flower. After flowering in July or August take a 'hay cut', ie cut back with a scythe, petrol strimmer or tractor mower to c.50mm. The 'hay' should be left to dry and shed seed for 1-7 days then removed from site. Mowing of the re-growth through to late autumn/winter to c.50mm can be done, and again in spring if needed.

### Hurrells Seeds

- 3.15 Hurrells Seeds provided the species mixes set out in Tables 3.4 and 3.5 for dry grassland on heavier ground and MG10 marshy grassland habitats respectively. Hurrells suggest that the application rate of 30-40kg / ha is used.

<b>DRY GRASSLAND MIX – GOING ON HEAVIER GROUND</b>	
0.90%	AGRIMONY
0.15%	AUTUMN HAWKBIT
1.20%	BIRDSFOOT TREFOIL
0.30%	BLADDER CAMPION
1.30%	COMMON KNAPWEED
0.70%	COMMON SORREL
1.00%	COMMON TREFOIL
0.30%	DEVILS BIT SCABIOUS
0.30%	FIELD SCABIOUS
0.30%	GREATER KNAPWEED
1.00%	LADY'S BEDSTRAW
0.80%	MEADOW BUTTERCUP
0.90%	MEADOWSWEET
0.90%	MUSK MALLOW
1.10%	OXEYE DAISY
0.15%	RAGGED ROBIN
1.30%	RED CAMPION
0.80%	RIBWORT PLANTAIN
1.00%	SALAD BURNET
1.30%	SELFHEAL
0.40%	TUFTED VETCH
0.50%	TOADFLAX (COMMON)
0.80%	WHITE CAMPION
0.70%	WILD CARROT
0.90%	YARROW
1.00%	YELLOW RATTLE
12.00%	CRESTED DOGSTAIL
24.00%	CHEWINGS FESCUE
24.00%	SLENDER CREEPING RED FESCUE
13.60%	HARD FESCUE
4.00%	BROWNTOP BENTGRASS
0.80%	YELLOW OATGRASS
0.80%	SMALL LEAVED TIMOTHY
0.80%	MEADOW FOXTAIL

**Table 3.4: Hurrells Recommended Seed Mix for Heavier Ground**

<b>MG10 SEED MIX</b>	
1.20%	SOFT RUSH
0.30%	CREEPING BUTTERCUP
0.20%	WILD ANGELICA
2.10%	SELFHEAL
1.80%	HARD RUSH
1.10%	YELLOW FLAG IRIS
1.90%	MEADOWSWEET
1.60%	GREATER/MARSH BIRDSFOOT TREFOIL
0.10%	RAGGED ROBIN
1.90%	MEADOW BUTTERCUP
2.00%	WHITE CLOVER
0.80%	SHEEPS SORREL
2.00%	RIBWORT PLANTAIN
1.90%	RED CLOVER
0.70%	DANDELION
0.20%	WATER MINT
0.20%	TUFTED VETCH
5.00%	YORKSHIRE FOG
5.00%	CREEPING BENT
8.00%	TIMOTHY
1.00%	MEADOW FOXTAIL
5.00%	ROUGH STALKED MEADOW GRASS
8.00%	MEADOW FESCUE
20.00%	SLENDER CREEPING RED FESCUE
7.00%	COCKSFOOT
5.00%	SMOOTH STALKED MEADOW GRASS
1.00%	SWEET VERNAL GRASS
10.00%	CRESTED DOGSTAIL
5.00%	COMMON BENT

**Table 3.5: Hurrells Seeds Proposed MG10 Seed Mix**

### Wild Wales Seeds

- 3.16 A Wales-based company called Wild Wales Seeds, supply a potentially suitable alternative seed mixture for drier soils<sup>5</sup> and also for damp/neutral soils<sup>6</sup>. These seed mixes contain 80% low maintenance grasses for neutral soils, and 20% wildflowers as listed in Tables 3.6 and 3.7.
- 3.17 Wild Seeds Wales recommend a sowing rate of 4 g/m<sup>2</sup> and suggest that sowing should be completed between March – May or August – October.
- 3.18 Wild Wales Seeds also suggested that they could supply a Native Welsh Countryside Wildflower Mix which is a 50/50 wildflower/grass mix as these wildflower mixes aren't quite as aggressive as the standard, and the grass out compete the wildflowers. See: <https://www.wildwales-seeds.co.uk/product/native-welsh-countryside-wildflower-mix/>

<sup>5</sup> See: <https://www.wildwales-seeds.co.uk/product/general-purpose/>

<sup>6</sup> See: <https://www.wildwales-seeds.co.uk/product/neutral-damp-soils/>

<b>General Purpose Mixture</b>
<b>20% Wild Flowers:</b>
Birdsfoot Trefoil
Corn Chamomile
Corn Marigold
Corn Poppy
Cornflower
Knapweed
Ladys Bedstraw
Musk Mallow
Oxeye Daisy
Phacelia
Red Campion
Sainfoin
Salad Burnet
Self Heal
Vetch
White Campion
Wild Carrot
Yarrow
<b>80% Grasses:</b>
Bent grass
Chewing's fescue
Slender red fescue
Strong creeping red fescue

**Table 3.6: Wild Wales Seeds General Purpose Mixture**

<b>Nuetral / Damp Soils Mixture</b>
<b>20% Wild Flowers:</b>
Betony
Birdsfoot trefoil
Catsear
Common sorrel
Field scabious
Knapweed
Lady's bedstraw
Meadow buttercup
Oxeye daisy
Ragged robin
Selfheal
St John's wort
Tufted vetch
Yarrow
Yellow rattle
<b>80% Grasses:</b>
Sweet vernal
Slender red fescue
Sheep's fescue
Crested dogstail
Bent grass
Meadow grass

**Table 3.7: Wild Wales Seeds Neutral / Damp Soils Mixture**

### 3.3 SUMMARY

- 3.19 With respect to bespoke local seed collection, given the funding timescales for the project, the use of local seed collection is not considered possible for this project.
- 3.20 Three commercial seed suppliers (Emorsgate Seeds, Hurrells Seeds and Wild Wales Seeds) have confirmed that they would be able to supply seed mixtures for the species-rich grassland and marshy grassland habitats, but that they do not generally hold fen habitat seed mixtures.
- 3.21 Török et al (2011) in their review identified that when grassland restoration/creation is required in large areas (e.g. at least in several hectares), sowing densities of 20–45 kg/ha were used. All of the seed suppliers recommended application rates which fall within this range.
- 3.22 Utilising a wildflower/grass seed mix which was appropriate for the site to introduce species which are currently absent from the proposed Phase 3 land would ensure that the grassland habitat established well, and potentially provided the additional species for the site which are currently missing. Using a seed mix would also ensure rapid habitat establishment within the site, on completion of the habitat creation works.



## 4. PONDS AND WETLAND VEGETATION

### 4.1 INTRODUCTION

- 4.1 This chapter of the vegetation establishment strategy considers the potential vegetation establishment options for the ponds and associated wetland vegetation (the fen-type habitats which will surround the ponds).
- 4.2 The proposed designs (see Systra 'Proposed Layout' drawing series, refs: 23C33-DWG-12, 23C33-DWG-13, 23C33-DWG-14, 23C33-DWG-15. Rev: P01) includes the restoration of 2 no. existing ponds and the creation of an additional 6 new ponds within the Phase 3 land at Green Gates. The proposed pond layout has been designed by Systra and details of the pond sizes and profiles are given by Systra which incorporates the ecological designs for this element the wetland creation area.
- 4.3 Design criteria for ponds which provide optimal breeding habitat for great crested newts are set out by English Nature (2001):
- Each pond should be between 100m<sup>2</sup> and 300m<sup>2</sup> in size and should have varying depths, up to 4m deep.
  - The ponds should be designed to hold water in at least one summer in every three and pond clusters are preferable to isolated individual ponds.
  - Each pond should contain both deeper areas of open water, for courtship, with shelves created to allow growth of marginal and emergent vegetation.
  - The ponds should be designed so that they aren't shaded along the southern edge.
- 4.4 The ponds have been designed to provide optimal amphibian habitat, within the context of the other design considerations (e.g. hydrology, sediments, topography etc) which are detailed in the accompanying Systra report. The ponds have been designed so that an areas of 'shelves' for the establishment of marginal and emergent vegetation are included around the central water column area which will be deeper (up to 2m deep) to provide great crested newt 'courtship' areas and allow growth of floating aquatic vegetation. It is recognised that GG9 will be a large pond (larger than the optimal size set out by English nature, 2001, above) as it will not only provided habitat for amphibians, but will also provide a focal point for the new Biodiversity Hub building which will overlook this area of open water.
- 4.5 A series of swales are proposed to be created as part of the pond design. These will be relatively shallow, linear features, and as such, are proposed to be subject to the same grassland creation work set out in Section 3.

### 4.2 SEEDING

- 4.6 A discussion associated with the different seed supplier options is given in Chater 3 and not repeated here. It is understood that some of the commercial seed suppliers are able to provide a 'pond edge mix'<sup>7</sup> or 'wetland pond edge mix'<sup>8</sup> which may be suitable for sowing at the pond edges and into the fen-type habitat areas which are proposed to surround the ponds. The mixes detailed below include both grasses (80%) and wetland plant species (20%). Table 4.1

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<sup>7</sup> See: <https://wildseed.co.uk/product/mixtures/complete-mixtures/special-habitat-mixtures/pond-edge-mixture/>

<sup>8</sup> See: <https://www.wildwales-seeds.co.uk/product/wetland-pond-edge/>

presents the proposed seed mix from Emorsgate Seeds and Table 4.2 provides details of a similar seed mix from Wild Wales Seeds.

- 4.7 Either of these seed mixes should be sown at a rate of 4g / m<sup>2</sup> over the relevant habitat areas (see Table 2.1).
- 4.8 Emorsgate recommend that sowings on ground prone to winter flooding are safest either in late summer or in spring once the land has drained. Most plants need time to grow mature enough to withstand flooding. The seed must be surface sown and can be applied by machine or broadcast by hand.
- 4.9 Emorsgate recommend that in the first year, annual weed growth may be cut back to encourage the development of a good perennial ground cover. They identify that establishment on sites prone to flooding may be patchy and may take several years to fully colonise.
- 4.10 The habitat value of pond edge sowings is enhanced if there are a variety of vegetation structures from dense tussock stands to bare and recently colonised mud and Emorsgate recommend that management of wetland areas should therefore aim to create variation with minimum disturbance to animal populations. They suggest that variation in structure can be achieved by cutting back and removing short sections of vegetation every 2-3 years in rotation. With ponds, they suggest removing vegetation as a wedge, but do state that dense stands of single species (eg yellow iris) may benefit from selective thinning.
- 4.11 Vegetation removal causes the least disruption to wildlife when carried out between September and November.
- 4.12 Whilst the seed mixes are proposed for the pond edges and the fen habitat type areas, Emorsgate conclude that establishment of emergent pond vegetation and other aquatic plants is best achieved using plants. Further details are given in Section 4.4.

Percentage	Common Name	Scientific Name
<b>20% Wild Flowers:</b>		
2.40%	Common knapweed	<i>Centurea nigra</i>
0.20%	Corky-fruited water-dropwort	<i>Oenanthe pimpinelloides</i>
0.80%	Crosswort	<i>Cruciata laevipes</i>
1.00%	Grey sedge (w)	<i>Carex divulsa subsp. divulsa</i>
0.20%	Gypsywort	<i>Lycopus europaeus</i>
1.00%	Hedge bedstraw	<i>Galium album</i>
0.20%	Hedgerow crane's-bill	<i>Geranium pyrenaicum</i>
0.10%	Hemp agrimony	<i>Eupatorium cannabinum</i>
1.00%	Meadow buttercup	<i>Ranunculus acris</i>
0.80%	Meadow vetchling	<i>Lathyrus pratensis</i>
1.70%	Meadowsweet	<i>Filipendula ulmaria</i>
0.50%	Purple loosestrife	<i>Lythrum salicaria</i>
0.70%	Ragged robin	<i>Silene flos-cuculi</i>
2.80%	Red campion	<i>Silene dioica</i>
0.60%	Ribwort plantain	<i>Plantago lanceolata</i>
0.20%	Selfheal	<i>Prunella vulgaris</i>
0.60%	Water avens	<i>Geum rivale</i>
1.00%	Wild angelica	<i>Angelica sylvestris</i>
0.60%	Wild teasel	<i>Dipsacus fullonum</i>
4.00%	Yellow iris	<i>Iris pseudacorus</i>
<b>80% Grass Species:</b>		
4.00%	Common bent	<i>Agrostis capillaris</i>
34.40%	Crested dogstail	<i>Cynosurus cristatus</i>
1.00%	Grey sedge (w)	<i>Carex divulsa subsp. divulsa</i>
4.00%	Meadow barley (w)	<i>Hordeum secalinum</i>
20.00%	Red fescue	<i>Festuca rubra</i>
4.00%	Sweet vernal-grass (w)	<i>Anthoxanthum odoratum</i>
2.40%	Tall fescue	<i>Schedonorus arundinaceus</i>
1.60%	Tufted hair-grass (w)	<i>Deschampsia cespitosa</i>

**Table 4.1: Emorsgate Pond Edge Mixture** (from Emorsgate Seeds)

Common Name	Scientific Name*
<b>20% Wild Flowers:</b>	
Betony	<i>Betonica officinalis</i>
Birdsfoot trefoil	<i>Lotus corniculatus</i>
Knapweed	<i>Centurea sp.</i>
Common mouse's ear	<i>Cerastium fontanum</i>
Common fleabane	<i>Pulicaria dysenterica</i>
Marsh marigold	<i>Caltha palustris</i>
Meadowsweet	<i>Filipendula ulmaria</i>
Meadow buttercup	<i>Ranunculus acris</i>
Purple loosestrife	<i>Lythrum salicaria</i>
Primrose	<i>Primula vulgaris</i>
Pendulous sedge	<i>Carex pendula</i>
Oxeye daisy	<i>Leucanthemum vulgare</i>
Ragged robin	<i>Silene flos-cuculi</i>
Ribwort plantain	<i>Plantago lanceolata</i>
Selfheal	<i>Prunella vulgaris</i>
Yarrow	<i>Achillea millefolium</i>
Wild carrot	<i>Daucus carota</i>
Gypseywort	<i>Lycopus europaeus</i>
<b>80% Grasses:</b>	
Chewing's fescue	<i>Festuca rubra subsp. commutata</i>
Crested dogstail	<i>Cynosurus cristatus</i>
Meadow foxtail	<i>Alopecurus pratensis</i>
Slender red fescue	<i>Festuca rubra litoralis</i>
Sweet vernal	<i>Anthoxanthum odoratum</i>
Tufted hairgrass	<i>Deschampsia cespitosa</i>
Yellow oatgrass	<i>Trisetum flavescens</i>

\*Scientific names were not provided by Wild Wales Seeds website

**Table 4.2: Wild Wales Seeds Wetland Pond Edge Mixture**

### 4.3 'SEED' BOMBS

- 4.13 The habitat creation proposals include the restoration and creation of a series of amphibian ponds. The site is known to support a small population of great crested newts, and the wider area (particularly to the west) is a key location for great crested newts in North Wales. Within St Asaph Business Park and Glascoed Nature Reserve to the west are numerous ponds which could provide vegetation which is of local provenance. Translocating turves from these ponds is not recommended due to the potential for damaging the donor ponds (which support breeding great crested newts). However, the use of 'seed bombs' could be considered.
- 4.14 McBride et al (2011) presented a case study which used 'seed bombs' to establish vegetation within ponds situated within a fen habitat. Material from the sedges, reeds and bog bean which formed a 'strand line' following the retreat of annual winter floods was collected when the material was still damp. It was transported in freezer bags and then the material was simply thrown into the new waterbodies and allowed to disperse naturally. The vegetation took two growing years to establish, but the results were favourable, with some rare sedge species successfully established in the new ponds following the use of the seed bombs.
- 4.15 If direct planting of plugs in the ponds, or using commercially available seed mixes is not proposed, then using 'seed bombs' from ponds within the St Asaph Business Park and / or Glascoed Nature Reserve could be an alternative establishment option. Permissions would need to be secured from the ponds owners / managers (Welsh Government / Wild Ground), and if there is a risk that the ponds contain any invasive non-native species (INNS), they would not be appropriate for use. Botanical surveys of the pond vegetation would need to be completed prior to their use to ensure no translocation of INNS.
- 4.16 Alternatively, direct seed collection from the pond areas at St Asaph Business Park / Glascoed Nature Reserve may also be possible, if the collection of seed bomb vegetation is not feasible, or if vegetation establishment using seed bombs within the ponds at Green Gates Phase 3 is unsuccessful.

### 4.4 PLUG PLANTING – POND EDGE PLANTS AREA

- 4.17 As discussed in the accompanying 'Green Gates Phase 3 – Great Crested Newt European Protected Species Licence Application: Method Statement' report (ref: R-BA194-01), three created ponds within the Tree Nursery area at Green Gates have adopted a vegetation establishment strategy utilising natural colonisation. Whilst it is recognised that these ponds are relatively shallow, the colonisation of these features with wetland vegetation has been quite slow. Denbighshire County Council ecologists provided ecological information about the ponds in April 2024, and state that the ponds support some emergent and floating vegetation including *Juncus* sp., greater reedmace *Typha latifolia* and great willowherb *Epilobium hirsutum* and *Potamogeton* sp. One of the ponds (GG3) has a covering of algae, suggesting eutrophication of this pond.
- 4.18 Whilst it is agreed that the use of natural colonisation is a good vegetation establishment option for the proposed ponds within the Phase 3 land, there is a need to ensure that the ponds quickly establish a good density of vegetation as great crested newts (GCN) were recorded in one of the ponds (GG6) which will be restored as part of the proposed works. As GCN are known to utilise this pond, it is important that suitable vegetation is established quickly to allow GCN to use this pond (and the associated vegetation) for egg laying. It is therefore proposed that the restored and created ponds are planted using native species plug plants.

- 4.19 Table 4.3 provides a list of native species which could be planted within the ponds to provide optimal habitat for a range of invertebrates and amphibians. If plug planting is used, 30% of the area targeted for wetland vegetation should be planted, using 35ml plugs at a rate of 9 plugs / m<sup>2</sup>. The 'Systra 'Proposed Layout' design drawings show areas of plug planting and reedbed planting around each pond. For these areas, 50% of the area will be planted using pond plug plants, and 50% will be planted using a reedbed mix (see Section 4.5). Within the pond plug planting area 30% of each area will be planted with plug plants at a rate of 9 plugs / m<sup>2</sup>. Details for the plug planting associated with the proposed ponds are given in Table 4.3.
- 4.20 Planting works should be carried out ideally in early May, when water levels in the ponds are high, and the plugs will have a summer's growing season to establish. However, it is recognised that this is beyond the timescale for delivery of the habitat creation works in accordance with current funding arrangements, and as such, this plug planting may need to be completed by the end of March 2025.
- 4.21 Once vegetation within each pond is established, 10 to 20% of the emergent vegetation at the water's edge should be removed per year in rotation depending on the rate of establishment.

Common Name	Scientific Name	Percentage in Each Pond	Pond GG4	Pond GG6	Pond GG7	Pond GG8	Pond GG9	Pond GG10	Pond GG11	Pond GG12*	Pond GG13	Area 1a Channels
<i>Marginal Vegetation Area:</i>			58 m <sup>2</sup>	60m <sup>2</sup>	183 m <sup>2</sup>	183 m <sup>2</sup>	840 m <sup>2</sup>	62 m <sup>2</sup>	62 m <sup>2</sup>	150 m <sup>2</sup>	66 m <sup>2</sup>	138 m <sup>2</sup>
<i>Marginal Vegetation Planting Area:</i>			17 m <sup>2</sup>	18 m <sup>2</sup>	55 m <sup>2</sup>	55 m <sup>2</sup>	252 m <sup>2</sup>	19 m <sup>2</sup>	19 m <sup>2</sup>	45 m <sup>2</sup>	20 m <sup>2</sup>	41 m <sup>2</sup>
<i>Note – plant 30% of marginal vegetation planting area with plugs @ 9 plugs / m<sup>2</sup></i>			153 plugs	162 plugs	495 plugs	495 plugs	2268 plugs	171 plugs	171 plugs	405 plugs	180 plugs	369 plugs
<i>Marginal / Emergent Species</i>												
Amphibious bistort	<i>Persicaria amphibia</i>	10%	15	16	50	50	226	17	17	40	18	37
Brooklime	<i>Veronica beccabunga</i>	15%	24	25	71	71	343	26	26	62	27	55
Marsh marigold	<i>Caltha palustris</i>	10%	15	16	50	50	226	17	17	40	18	37
Water forget-me-not	<i>Myosotis scorpioides</i>	10%	15	16	50	50	226	17	17	40	18	37
Water plantain	<i>Alisma plantago-aquatica</i>	10%	15	16	50	50	226	17	17	40	18	37
Yellow flag iris	<i>Iris pseudacorus</i>	10%	15	16	50	50	226	17	17	40	18	37
Common water crowfoot	<i>Ranunculus aquatilis</i>	15%	24	25	71	71	343	26	26	63	27	55
Purple loosestrife	<i>Lythrum salicaria</i>	10%	15	16	50	50	226	17	17	40	18	37
Water mint	<i>Mentha aquatica</i>	10%	15	16	50	50	226	17	17	40	18	37
<i>Floating Species / Oxygenators</i>												
Common water starwort	<i>Callitriche stagnalis</i>	-	1 bunch	1 bunch	1 bunch	1 bunch	4 bunches	1 bunch	1 bunch	-	1 bunch	-
Water milfoil	<i>Myriophyllum spicatum</i>	-	1 bunch	1 bunch	1 bunch	1 bunch	4 bunches	1 bunch	1 bunch	-	1 bunch	-

\*Note – GG12 is an online feature. Planting of marginal plants will be completed along edge.

**Table 4.3: Proposed Aquatic and Marginal Pond Species at Green Gates Phase 3**

#### 4.5 PLUG PLANTING – REEDBED

- 4.22 Eades et al (2003) state that pot-grown reeds have been successfully utilised at a series of large-scale reedbed creation projects. The difficult germination stage of common reed *Phragmites australis* is undertaken under controlled conditions and as such, establishment success is greater than simply using seeds. Success-rates of using pot-grown reed plugs for reedbed establishment have been reported at over 90% (Sussex Wildlife Trust, 2013), and potentially even approaching 100% (RSPB, 2004) if conditions are optimal.
- 4.23 With respect to planting densities for reedbed habitats, different documents recommend different spacings:
- ◆ BTCV (1997) suggest that new reedbeds be planted with seedlings at 1 m spacings, to give a full cover within one year. Alternatively pots containing clusters of seedlings can be used and will spread rapidly in all directions, these can be spaced at 2-3 m intervals.
  - ◆ Eades et al (2003) recommend a planting density of 2-8 plugs/m<sup>2</sup> with higher densities increasing the reed take and minimising competition.
  - ◆ RSPB (2004 & 2019) state that individual seedlings are usually planted at densities of 1-4 per m<sup>2</sup>.
  - ◆ Sussex Wildlife Trust (2013) suggest planting individual seedlings at densities of 4 per m<sup>2</sup>.
- 4.24 Both the RSPB (2004 & 2019) and Sussex Wildlife Trust (2013) state that it takes c.540 person hours to plant 1 ha of reedbed using pot-grown reed plugs at a density of c.4 per m<sup>2</sup>.
- 4.25 Eades et al (2003) state that plugs should be planted from April to July, although April to May is the optimal time, whereas BTCV (1997) suggest that the best time for planting plugs is May/June when plants will quickly establish. The RSPB (2004) conclude that it is best to plant in June, as early as possible after the frosts have ceased. However they also identify that an alternative option may be to plant big seedlings late in the season after competition has been controlled. BTCV (1997) also suggest that alternative planting in September / October may be successful.
- 4.26 With respect to water levels, Eades et al (2003) state that for pot grown reeds, water levels should be at or just above the ground surface for planting (10-20 mm), and then water levels should be maintained at 50 mm above ground level during the first year of establishment. Sussex Wildlife Trust (2013) suggest that planting when water levels are 50 mm above the surface is best. The RSPB (2004 and 2019) recommend that water levels should be at or just above the soil surface during planting and that seedlings less than a year old can tolerate water levels up to 0.20 m above the topmost shoots, but only for short periods.
- 4.27 If it is assumed that plugs are planted at a rate of 4 plugs / m<sup>2</sup> and that 20% of the total reedbed area in each field within the Phase 3 land is planted to ensure a quick habitat establishment, Table 4.4 shows the proposed reedbed planting areas at Green Gates Phase 3.

Common Name	Scientific Name	Percentage in Each Reedbed Area	Pond GG4	Pond GG7	Pond GG8	Pond GG9	Pond GG12*	Area 1a Channels
<i>Reedbed Area:</i>			58 m <sup>2</sup>	183 m <sup>2</sup>	183 m <sup>2</sup>	840 m <sup>2</sup>	150 m <sup>2</sup>	138 m <sup>2</sup>
<i>Reedbed Planting Area:</i>			12 m <sup>2</sup>	36 m <sup>2</sup>	36 m <sup>2</sup>	168 m <sup>2</sup>	30 m <sup>2</sup>	27 m <sup>2</sup>
<i>Note – plant 20% of reedbed planting area with plugs @ 4 plugs / m<sup>2</sup></i>			48 plugs	144 plugs	144 plugs	672 plugs	120 plugs	108
<i>Reedbed Species</i>								
Common reed	<i>Phragmites australis</i>	90%	44	129	129	606	108	97
Branched bur reed	<i>Sparganium erectum</i>	1%	1	1	2	7	2	2
Common cotton grass	<i>Eriophorum angustifolium</i>	1%	1	2	1	7	1	1
Flag iris	<i>Iris pseudacorus</i>	1%	-	1	2	7	1	1
Flowering rush	<i>Botumus umbellatus</i>	1%	1	2	1	7	1	1
Marsh marigold	<i>Caltha palustris</i>	1%	-	1	2	6	1	1
Marsh woundwort	<i>Stachys palustris</i>	1%	-	2	1	7	1	1
Water forget-me-not	<i>Myosotis scorpioides</i>	1%	-	1	2	6	1	1
White sedge	<i>Carex curta</i>	1%	1	2	1	7	2	1
Purple loosestrife	<i>Lythrum salicaria</i>	1%	-	1	2	6	1	1
Water mint	<i>Mentha aquatica</i>	1%	-	2	1	6	1	1

\*Note – GG12 is an online feature. Planting of reedbed plants will be completed along edge.

For Pond GG4 due to small area, species chosen for planting in reedbed area are different species from those detailed in Table 4.3.

**Table 4.4: Proposed Species for Planting within Reedbed Areas at Green Gates Phase 3**



#### 4.6 PLUG PLANTING – FEN

- 4.28 Table 2.2 identified that given the areas of fen habitat which are proposed at the site, and DCC's longer-term aspiration to use the Tree Nursery for growing plants other than trees, the use of fenland plug plants to establish the fen-type habitat at the site is proposed.
- 4.29 Introducing plug plants to an area of fen is a viable vegetation establishment option which can ensure a rapid 'greening' of the site as they generally establish well. McBride et al (2011) warn that the purchase of plug plants for establishing fen habitats can be expensive and planting is very labour intensive (McBride et al (2011) suggests that in general in peatlands plug plants can be planted at a rate of 100 - 120 plugs / person / hour).
- 4.30 It is proposed that the fen-type habitat areas be established with species which will eventually create a tall herb fen, taking the National Vegetation Classification S25 tall-herb fen (Rodwell, (1995) as a point of reference. This fen community contains tall herbaceous dicotyledons amongst which hemp agrimony *Eupatorium cannabinum*, wild angelica *Angelica sylvestris*, purple loosestrife *Lythrum salicaria*, Valerian *Valeriana officinalis*, yellow flag iris *Iris pseudocorus* and meadowsweet *Filipendula ulmaria* are found alongside common reed *Phragmites australis*.
- 4.31 For the fen areas, it is considered appropriate to adopt a similar planting density to the reedbed areas, with 20% of the habitat area planted using plugs at a density of 4 plugs / m<sup>2</sup>. Based on this criteria, Table 4.5 shows the proposed fen planting areas at Green Gates Phase 3.

Common Name	Scientific Name	Percentage in Fen Habitat Area	Field 1a	Field 1b
<i>Total Fen-Type Habitat Area:</i>			3210 m <sup>2</sup>	75 m <sup>2</sup>
<i>Planting Area:</i>			642 m <sup>2</sup>	15 m <sup>2</sup>
<i>Plant 20% of fen habitat area with plugs @ 4 plugs / m<sup>2</sup>.</i>			2568 plugs	60 plugs
<i>Fen Species</i>				
Common reed	<i>Phragmites australis</i>	45%	1155	27
Hemp agrimony	<i>Eupatorium cannabinum</i>	5%	128	3
Wild angelica	<i>Angelica sylvestris</i>	5%	129	3
Purple loosestrife	<i>Lythrum salicaria</i>	5%	128	3
Valerian	<i>Valeriana officinalis</i>	5%	129	3
Yellow flag iris	<i>Iris pseudocorus</i>	5%	128	3
Meadowsweet	<i>Filipendula ulmaria</i>	5%	129	3
Common marsh bedstraw	<i>Galium palustre</i>	5%	128	3
Marsh thistle	<i>Cirsium palustre</i>	5%	129	3
Tufted vetch	<i>Vicia cracca</i>	5%	128	3
Marsh marigold	<i>Caltha palustris</i>	5%	129	3
Water forget-me-not	<i>Myosotis scorpioides</i>	5%	128	3

**Table 4.5: Proposed Species for Planting within Fen-Type Habitat Areas at Green Gates Phase 3**

## 4.7 SUMMARY

- 4.32 This chapter sets out the proposed vegetation establishment approach using plug plants surrounding the pond open water habitat areas, and within the reedbed and fen-type habitat areas. Plug planting at rates which should ensure a rapid establishment of the habitats have been provided. In addition, the species-mixes proposed will ensure that a diverse mix of aquatic, marginal and emergent vegetation species are included within the main wetland areas at the site.
- 4.33 It should be noted that there are a number of risks to establishing vegetation when plug planting is used including:
- ◆ Excessive flooding;
  - ◆ Excessive drought;
  - ◆ Overgrazing by animals (deer, geese, rabbits and wildfowl).
- 4.34 Whilst it is understood that a deer fence will be installed around the Phase 3 land, this will not reduce the risk of grazing from rabbits or wildfowl. At other wetland creation sites the following temporary vegetation protection fencing specification has been used (generally mostly applicable for areas of reedbed planting): Fencing posts installed to comprised 50 - 75 mm diameter rounds softwood posts, pressure treated with tanalin. 1.6 m high driven 0.5 m into the ground. Posts to be installed at 4 m centres. Galvanised wire strands to be attached 50 mm from the top and bottom of the posts.
- 4.35 It is recommended that temporary protection fencing be installed around the areas of plug planting within the ponds as part of the vegetation establishment activity. Vegetation protection fencing would need to be removed from the habitat once the plug plants are suitably established (likely to be in 2-3 years). DCC may chose to investigate the availability of biodegradable vegetation protection fencing rather than using the specification provided above, as this fencing may not require removal from the site.

## 5. WOODLAND AND SCRUB

### 5.1 INTRODUCTION

- 5.1 This chapter of the vegetation establishment strategy considers the proposed planting mixtures for the woodland and scrub habitats at the Green Gates Phase 3 site. It is recognised that there are two different key areas for planting woody species:
- ◆ Within the woodland planting blocks in Areas 1a, 1c and North Field, the woody species planting will comprise a more 'terrestrial' woodland mixture as these areas of the site are located some distance from the proposed wetland habitats and the planting will be designed to be situated on landscape deposition areas, created using the material from the habitat creation excavation works.
  - ◆ Within Areas 1a and 1c some of the woodland and scrub planting will take the form of a more 'wet woodland / willow carr' type habitat as these areas will form an ecotone with the ponds, wet grassland and species-rich grassland habitats.
- 5.2 It is understood that the trees which will be used for planting in the Phase 3 area will be grown at the Tree Nursery on site. The species lists presented in this section may therefore need to be revised by DCC based on their species availability, as the current species stock of trees at the Tree Nursery has not been provided by DCC.

### 5.2 TERRESTRIAL WOODLAND

- 5.3 Within Areas 1a, 1c and North Field where woodland and scrub is proposed (in order to meet DCC's woodland vegetation cover targets) to be created, on areas which have been used for the deposition of excavated materials, a terrestrial woodland habitat is proposed.
- 5.4 The creation of this woodland type will complement the retained grassland habitats in addition to the existing hedgerow to the south and the scattered mature trees and scrub habitats along the western boundary of the site, in addition to the proposed woodland planting within the eastern part of the Green Gates site.
- 5.5 No species mix is provided in this report for these habitats, as it is understood that a terrestrial woodland planting mix has already been developed for the eastern part site, and it is proposed that the same species mix be used in the terrestrial woodland areas within the Phase 3 land.
- 5.6 Planning Policy Wales (PPW12)<sup>9</sup> provides guidance on national planning policy and includes information with respect to planting of trees, as it is recognised that tree planting, in the correct location, can contribute positively towards Wales' climate targets. Where woodland is proposed as part of a compensation package, PPW12, paragraph 6.4.42 suggests that a minimum planting rate of 1600 trees per ha is used for broadleaved woodland habitats. As discussed previously, the rapid establishment of habitats at the site is a key driver for the project, and as such, a density of 1800 trees / ha may be more appropriate.

### 5.3 CARR WOODLAND

- 5.7 Within Areas 1a and 1c where woodland and scrub is proposed (in order to meet DCC's woodland vegetation cover targets) to be created, but there will not be any deposition of excavated materials, a carr woodland habitat is proposed.

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<sup>9</sup> See: Planning Policy Wales (PPW12). Available at: <https://www.gov.wales/planning-policy-wales>.

- 5.8 The creation of this woodland type will complement the area of willow carr which is already developing at Pond GG5, located between Areas 1a and 1c and will contribute to the mosaic of wetland and terrestrial habitats proposed for the site.
- 5.9 It is understood that the Denbighshire Tree Nursery is growing native black poplar trees, collected from local sources and as such, these trees have been included within the carr woodland planting mix. Whilst it is recognised that carr woodland will grow in such a way that some tree specimens will grow as 'scrub' rather than standard trees, it is recommended that the native black poplar trees included in each area are managed in such a way that these trees grow to maturity as standards.
- 5.10 Table 5.1 provides a species list for the proposed carr woodland habitat areas.
- 5.11 As discussed above, a density of 1800 trees / ha has been used as this exceeds the minimum requirements set out in Planning Policy Wales (PPW12), paragraph 6.4.42.

Common Name	Scientific Name	Percentage Willow Carr Area	Area 1a	Area 1b
<i>Willow Carr Area:</i> <i>Trees to be planted at density of 1800 trees per ha (PPW12).</i>			0.321 ha 578 trees	0.0075 ha 14 trees
<i>Carr Woodland Species:</i>				
Goat willow	<i>Salix caprea</i>	20%	116	2
Guelder rose	<i>Viburnum opulus</i>	20%	116	2
Grey willow	<i>Salix cinerea</i>	20%	116	2
Alder	<i>Alnus glutinosa</i>	10%	59	2
Alder buckthorn	<i>Frangula alnus</i>	10%	59	2
White willow	<i>Salix alba</i>	5%	28	1
Crack willow	<i>Salix fragilis</i>	5%	28	1
Dog rose	<i>Sorbus aucuparia</i>	5%	28	1
Native black poplar	<i>Populus nigra</i> subsp. <i>betulifolia</i>	5%	28	1

**Table 5.2: Proposed Species for Planting within Carr Woodland Areas at Green Gates Phase 3**

#### 5.4 SUMMARY

- 5.12 It is understood that deer fencing is proposed to be installed around the perimeter of the Phase 3 land in order to control deer grazing which has proven to be a significant damaging impact on trees at the Tree Nursery on site. Grazing of young trees may also occur from other sources, such as rabbits and other small mammals, and as such, tree protection may be required around the trees during their early establishment phases. This should be informed by DCC's specialists within the Tree Nursery as they will understand local grazing pressures experienced at the site.
- 5.13 Management of the terrestrial woodland and carr woodland habitats will be required in the long-term. Management of the trees during their early establishment phase (Years 1-5) may require replacement of any losses. During their longer establishment phase (Years 5-20), management activities should be targeted at creating a varied woodland structure within each of the woodland planting areas. Long term management would need to be informed based on site-assessments, and should allow long-term development of a woodland habitat which supports a range of tree age-classes and features such as open areas (glades and rides), woodland 'edge' habitats and opportunities for natural woodland regeneration.
- 5.14 Whilst not considered to form part of this vegetation establishment strategy, Herbert et al (2022) identify that field-layer plant introductions are typically the most relevant group to consider as part of woodland creation. The introduction of field layer species can speed up

nature's recovery by rapidly providing additional resources and supporting wider natural colonisation by insects, other animals and fungi. In the long term DCC may consider whether the use of a woodland flora seed mix would provide additional woodland species to the proposed woodland habitats within the Phase 3 land. There are two options to introduce a diverse field layer (both of which could be completed):

- ◆ Sowing of a woodland seed mix (e.g. Emorsgate Woodland Mixture EW1<sup>10</sup>) beneath the created woodland habitat from Year 5. Woodland seed mixes are usually used as the canopy closes. Seeded areas could be managed as grassland between sowing and until the woodland canopy closes (likely to be around Year 10).
- ◆ Targeted plug planting of woodland specialist plants associated with lower light levels are best carried out later in the establishment stage, between Years 10 and 20. This planting could be done by focusing on patches of plants to act as sources for wider colonisation over time.

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<sup>10</sup> Emorsgate Seeds Woodland Mixture EW1. See: <https://wildseed.co.uk/product/mixtures/complete-mixtures/special-habitat-mixtures/woodland-mixture/>

## 6. HABITAT ESTABLISHMENT MATRIX

6.1 Table 6.1 presents a Vegetation Establishment Matrix for the site at Green Gates Phase 3 using data collected and discussed in the previous chapters. It should be noted that the strategy presented in Table 6.1 may be refined based on further assessment of the site project timescales, funding requirements, vegetation material availability and protected species avoidance / mitigation / compensation requirements.

Green Gates Phase 3 Proposed Habitat	Area of Proposed Habitat (m <sup>2</sup> )	Proposed Vegetation Establishment Technique	Timing Considerations	Notes
Species-rich grassland	5,989 m <sup>2</sup>	Use of commercially available seed mix: <ul style="list-style-type: none"> <li>◆ Meadow mixture for clay soils (EM4) from Emorsgate Seeds</li> <li>◆ Dry grassland mix for heavier ground mix from Hurrells Seeds</li> <li>◆ General purpose mix from Wild Wales Seeds</li> </ul>	Commercial seed order – by Sept 2024  Seed sowing – March to May 2025	Sowing may need to be completed in March 2025 to fulfil funding requirements.
Marshy grassland	2,396 m <sup>2</sup>	Use of commercially available seed mix: <ul style="list-style-type: none"> <li>◆ Meadow mixture for wetlands (EM8) from Emorsgate Seeds</li> <li>◆ MG10 seed mix from Hurrells Seeds</li> <li>◆ Neutral / Damp Soils Mix from Wild Wales Seeds</li> </ul> <p>Include area of ‘swales’ associated with each pond as part of this habitat establishment.</p>	Commercial seed order – by Sept 2024  Seed sowing – March to May 2025	Sowing may need to be completed in March 2025 to fulfil funding requirements.
Fen-type habitat	3,284 m <sup>2</sup>	Plug planting using fen-type habitat mix (see Table 4.5). Plant at rate of 4 plugs/m <sup>2</sup> . Plant 20% of fen-type habitat area to ensure rapid habitat establishment. Ensure plug planting protection fencing is in place.	Plug planting – May 2025	Plug plants may need to be delivered to site by the end of March 2025 to fulfil funding requirements.  Alternatively DCC may chose to grow their own plug plants. May require seed donor sites.

**Table 6.1: Vegetation Establishment Matrix for Green Gates Phase 3 (continues)**

Green Gates Phase 3 Proposed Habitat	Area of Predicted Habitat (ha)	Proposed Vegetation Establishment Technique	Timing Considerations	Notes
Reedbed	1,524 m <sup>2</sup>	Plug planting using reedbed mix (90% common reed, see Table 4.4). Plant at rate of 4 plugs/m <sup>2</sup> . Plant 20% of reedbed area to ensure rapid habitat establishment. Ensure plug planting protection fencing is in place.	Commercial plant plug supply to be secured - by Sept 2024  Plug planting – May 2025	Plug plants may need to be delivered to site by the end of March 2025 to fulfil funding requirements.
Pond Planting Area	1,684 m <sup>2</sup>  (8 no. ponds and channels in Area 1a)	Pond plug planting using pond plant mix (see Table 4.3). Plant at rate of 9 plugs/m <sup>2</sup> . Plant 30% of area to ensure rapid habitat establishment. Ensure plug plant protection fencing is in place.  Use of commercially available seed mix: <ul style="list-style-type: none"> <li>◆ Pond Edge Mix from Emorsgate Seeds</li> <li>◆ Wetland Pond Edge Mixture from Wild Wales Seeds</li> </ul> Possibly use 'seed bombs' from wetland edge habitats from St Asaph Business Park / Glascoed Nature Reserve.	Commercial seed order – by Sept 2024  Seed sowing – March to May 2025  Plug planting – May 2025  Seed bombs (if used) – Autumn 2025	Plug plants may need to be delivered to site by the end of March 2025 to fulfil funding requirements.  Sowing may need to be completed in March 2025 to fulfil funding requirements.  Use of 'seed bombs' may not be possible due to timing constraints / donor site survey results.
Carr Woodland and Scrub	3,284 m <sup>2</sup>	Tree planning using carr woodland mix (see Table 5.1). Plant at rate of 1800 trees / ha. Ensure tree protection is in place during establishment.	Tree planting – February 2025	Tree planting may need to be completed in March 2025 to fulfil funding requirements.
Terrestrial Woodland and Scrub	32,521 m <sup>2</sup>	Tree planning using terrestrial woodland mix as per Green Gates Nature Reserve scheme. Plant at rate of 1800 trees / ha. Ensure tree protection is in place during establishment.	Tree planting – February 2025 NOTE - tree planting works can only be completed once earthworks have been finished.	Tree planting may need to be completed in March 2025 to fulfil funding requirements.

**Table 6.1 (continued): Vegetation Establishment Matrix for Green Gates Phase 3**

## 7. BIOSECURITY CONTROL MEASURES

### 7.1 INTRODUCTION

- 7.1 This chapter of the report provides a series of biosecurity control measures associated with vegetation establishment at the Green Gates Phase 3 habitat restoration and creation site.
- 7.2 Biosecurity considerations aim to reduce the risk of introducing or spreading invasive non-native species (and other harmful organisms such as diseases) in the wild<sup>11</sup>. Invasive Non-native Species (INNS) are plants, animals, fungi and microorganisms which have been introduced to parts of the world where they would not naturally be found. They have the ability to spread causing damage to the environment, the economy, our health and the way we live. INNS are the second greatest threat to biodiversity after habitat loss and fragmentation.
- 7.3 Natural Resources Wales<sup>12</sup> state that the Invasive Alien Species (Enforcement and Permitting) Order 2019 gives effect to EU regulations on the prevention and management of the spread of invasive alien species. It lists 66 species which are of special concern of which 14 of the species (see below) are found in Wales. The regulations make it an offence to carry out any of the following activities with listed species, except where a licence, permit or exemption is in place:
- ◆ import
  - ◆ keep
  - ◆ breed
  - ◆ transport (except transporting for eradication)
  - ◆ place on the market
  - ◆ exchange
  - ◆ allow to grow, cultivate or permit to reproduce
  - ◆ release into the environment
- 7.4 The 14 species identified as being widely spread in England and Wales and requiring management are listed in Table 7.1.

Plants	Animals
Nuttall’s waterweed <i>Elodea nuttallii</i>	Egyptian goose <i>Alopochen aegyptiacus</i>
Chilean rhubarb <i>Gunnera tinctoria</i>	Chinese mitten crab <i>Eriocheir sinensis</i>
Giant hogweed <i>Heracleum mantegazzianum</i>	Muntjac deer <i>Muntiacus reevesi</i>
Floating pennywort <i>Hydrocotyle ranunculoides</i>	Signal crayfish <i>Pacifastacus leniusculus</i>
Himalayan balsam <i>Impatiens glandulifera</i>	Grey squirrel <i>Sciurus carolinensis</i>
Curly waterweed <i>Lagarosiphon major</i>	All subspecies of <i>Trachemys scripta</i> otherwise known as “slider terrapins”
American skunk cabbage <i>Lysichiton americanus</i>	
Parrot’s feather <i>Myriophyllum aquaticum</i>	

**Table 7.1: Widespread Invasive Alien Species in England and Wales listed on the Invasive Alien Species (Enforcement and Permitting) Order 2019**

<sup>11</sup> GB Non-Native Species Secretariate webpage. Accessed: 03-01-2024. Available: <https://www.nonnativespecies.org/>

<sup>12</sup> Natural Resources Wales. Invasive Alien Species Regulations website. Accessed: 23-04-21. Available: <https://naturalresources.wales/permits-and-permissions/species-licensing/invasive-alien-species/invasive-alien-species-regulations/?lang=en>



## 7.2 RISK ASSESSMENT

7.5 A Biosecurity Risk Assessment associated with the proposed habitat restoration and creation works is provided in Tables 7.2 to 7.4.

<b>Description of activities being assessed in this biosecurity risk assessment:</b>	<ul style="list-style-type: none"> <li>◆ Habitat creation works involving reduced level excavation and deposition of materials.</li> <li>◆ Planting of habitats within Phase 3 land.</li> </ul>
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**Table 7.2: Activities Associated with Habitat Creation and Vegetation Establishment Works at Green Gates Phase 3**

Invasive Species	Habitat / Species At Risk
<b>Himalayan Balsam</b> Himalayan Balsam is widely distributed in North Wales and occurs in both lowland and upland localities. The species is thought to have extended its range and abundance, particularly in wetland habitats.	<b>Habitats:</b> Ponds and watercourses
<b>Australian swamp stonecrop <i>Crassula helmsii</i></b> <i>Crassula helmsii</i> is known to exist in North Wales. The species is highly invasive and represents one of the principle factors that affect the long term ecological functionality of ponds as breeding sites for amphibians.	<b>Habitats:</b> Ponds <b>Species:</b> Great crested newt
<b>Water fern <i>Azolla filiculoides</i></b> <i>Azolla filiculoides</i> is known to exist in North Wales and has been previously recorded at Glascoed Nature Reserve to the west. The species is highly invasive and can spread rapidly across a pond, shading the water surface and causing problems for pond functioning. Considered to be a high risk non-native invasive species.	<b>Habitats:</b> Ponds <b>Species:</b> Great crested newt
<b>Other Invasive Non-Native Aquatic Plant Species</b> A range of invasive non-native plant species have been recorded to date in North Wales. The list below reviews risk species: <ul style="list-style-type: none"> <li>◆ Parrot's-feather <i>Myriophyllum aquaticum</i> – medium risk</li> <li>◆ Floating pennywort <i>Hydrocotyle ranunculoides</i> – high risk</li> <li>◆ Canadian waterweed <i>Elodea Canadensis</i> – medium risk</li> <li>◆ Curly waterweed <i>Lagarosiphon major</i> – medium risk</li> <li>◆ Nuttall's waterweed <i>Elodea nuttallii</i> – medium risk</li> <li>◆ Waterweeds (other <i>Elodea</i> sp.) <i>Elodea</i> spp. – medium risk</li> <li>◆ Least duckweed <i>Lemna miniscula</i> – high risk</li> </ul>	<b>Habitats:</b> Ponds <b>Species:</b> Great crested newt
<b>Chytrid (potential)</b> The Chytrid fungus was identified in Talacre and Johnstown in 2008 and is known to be widespread in Great Britain. This fungus has affected amphibian populations globally and has caused the extinctions of species. ARG-UK Advice Note 4 (March 2017) <sup>13</sup> provides generic guidance in respect of amphibian disease precautions.	<b>Habitats:</b> Non affected <b>Species:</b> Common toad <i>Bufo bufo</i> Great crested newt <i>Triturus cristatus</i> Smooth newt <i>Lissotriton vulgaris</i> Palmate newt <i>Lissotriton helveticus</i>

**Table 7.3: Habitats and Species with Specific Biosecurity Considerations for Green Gates Phase 3**

## 7.3 CONTROL MEASURES

7.6 Table 7.4 provides details of the biosecurity risks associated with the habitat restoration / creation and vegetation establishment works at the Green Gates Phase 3 and sets out the control measures which will need to be put in place to ensure that the potential biosecurity risks from the proposed activities are low.

<sup>13</sup> ARG Advice Note 4. Available at: <https://www.arguk.org/downloads-in-pages/resources/advice-notes/324-advice-note-4-amphibian-disease-precautions-a-guide-for-uk-fieldworkers-pdf-2/file>

Activity	Risk with Control Measures	Control Measures	Residual Risk
<b>Risk 1 – Amphibians.</b> Site visits by Ecological Clerk of Works / Earthworks Contractors / Landscape Contractors etc who have visited other sites.	Medium – Low	<ol style="list-style-type: none"> <li>1. Ensure all Ecological Clerk of Works / Contractor’s staff are aware of bio-security control measures.</li> <li>2. Disinfect and sterilize all equipment including clothing and footwear before and after each visit, including between sites (if applicable).</li> <li>3. All debris, plant fragments and mud should first be scrubbed off and rinsed with water. Disinfection should comprise soaking in a bleach solution (1 measure of household bleach to 9 measures water) for 15 minutes; or Virkon solution (1 mg/ml) for 1 minute; or fabrics can be washed on a 40°C cycle (with detergent, ensuring sufficient rinsing).</li> <li>4. All used disinfectants should be disposed of appropriately.</li> </ol>	Low
<b>Risk 2 - Amphibians.</b> Use of vehicles which may be carrying material from non-native invasive species. Relevant to contractors and Ecological Clerk of Work site visits.	Medium – Low	<ol style="list-style-type: none"> <li>1. Wherever possible ensure vehicles should use metalled roads and parking areas. Vehicles should be parked at the Tree Nursery.</li> <li>2. Sterilize wheels if vehicle has visited ponds / wetlands within previous 10 days.</li> </ol>	Low
<b>Risk 3 - Amphibians.</b> Use of plant, tools and equipment as part of habitat creation works and vegetation establishment activities.	Medium - Low	<ol style="list-style-type: none"> <li>1. Ensure all operatives are aware of bio-security control measures.</li> <li>2. Where possible, avoid using tools, plant and equipment that has been previously used on sites which are known to contain biosecurity risk species.</li> <li>3. All debris, plant fragments and mud should first be scrubbed off and rinsed with water before leaving site.</li> </ol>	Low
<b>Risk 4 – Spread of Invasive Non-Native Plants within the Site.</b> Spread of invasive non-native plants (INNS) from existing resource via earthworks machinery.	Low	<p><b>NOTE – no INNS known at the site to date. Risk to be regularly reviewed.</b></p> <ol style="list-style-type: none"> <li>1. Ensure contractors and staff know what INNS look like through Tool Box Talk.</li> <li>2. If any INNS plants are identified within the works area, appropriate species-specific control measures should be put in place immediately.</li> </ol>	Low
<b>Risk 5 – Amphibians and Restored / Created Habitats.</b> Habitat creation (planning, seeding etc) / reinstatement activities within habitats including: grassland, hedgerows, ponds, trees.	Medium – Low	<ol style="list-style-type: none"> <li>1. Ensure all operatives are aware of bio-security control measures.</li> <li>2. Disinfect and sterilize all equipment including clothing and footwear before and after each visit, including between sites (if applicable).</li> <li>3. All debris, plant fragments and mud should first be scrubbed off and rinsed with water before leaving site.</li> <li>4. All used disinfectants should be disposed of appropriately.</li> <li><b>5. No non-native species to be introduced as part of planting schemes, seed mixes etc. Use plants of local provenance where possible.</b></li> </ol>	Low

**Table 7.4: Biosecurity Risk Assessment – Habitat Creation and Vegetation Establishment Works at Green Gates Phase 3 (continues)**

Activity	Risk with Control Measures	Control Measures	Residual Risk
<p><b>Risk 6 – Introduction of Invasive Non Native Plants from Direct Planting Material.</b> Disposal of plant material from habitat establishment activities.</p>	<p>Medium – Low</p>	<ol style="list-style-type: none"> <li>1. Ensure all operatives are aware of biosecurity control measures.</li> <li>2. Ensure that all plant material brought onto site (for example in commercial seed mixes) is free of potential INNS species. Check control measures at supplier locations.</li> <li>3. For any other material brought onto site (e.g. seed-bombs to establish pond plants), an INNS survey of the donor site should be completed prior to the use of the material to ensure no INNS are introduced with the vegetative material.</li> <li>4. Dispose of all plant material in accordance with agreed protocols. Any surplus/discarded/disposable stock to be collected into a special container and taken away from the site for disposal (no storage on site).</li> <li>4. Keep any vegetation establishment areas tidy and clean to minimise risks of plant material escaping unexpectedly.</li> </ol>	<p>Low</p>

**Table 7.4 (continued): Biosecurity Risk Assessment – Habitat Creation and Vegetation Establishment Works at Green Gates Phase 3**

## 8. CONCLUSIONS AND RECOMMENDATIONS

### 8.1 CONCLUSIONS

- 8.1 This report has been produced by Biodiversity Advanced Ltd for Denbighshire County Council (DCC) and provides a Vegetation Establishment Strategy associated with a proposed habitat restoration and creation project at Green Gates Phase 3, St Asaph, Denbighshire.
- 8.2 The predicted habitats which are proposed for the site are shown on Systra 'Proposed Layout' drawing series (refs: 23C33-DWG-12, 23C33-DWG-13, 23C33-DWG-14, 23C33-DWG-15. Rev: P01) which has been used to inform this report. The predicted habitats include amphibian ponds and associated swales (restored and created), reedbed, fen-type wetland areas, wet grassland, species-rich grassland, scrub and woodland habitats. Retained habitats will include rough grassland, scattered mature trees, watercourses (streams), scrub and woodland, and an old pond / willow carr area.
- 8.3 A series of vegetation establishment techniques were identified as being potentially appropriate for the site, and the opportunities and constraints of each of these has been considered separately in this report.
- 8.4 Natural regeneration is not proposed as a vegetation establishment option as the lack of existing vegetation resource, timescales for the project and the available funding drivers, and the need to provide optimal habitat for protected species known to utilise the site (for example, great crested newts using the ponds for breeding and egg laying) do not allow for this option to be successfully adopted.
- 8.5 Commercially available seed was reviewed through correspondence with seed suppliers to consider the potentially suitable seed mixes which could be available for use in this project. Three commercial seed suppliers (Emorsgate Seeds, Hurrells Seeds and Wild Wales Seeds) confirmed that they would be able to supply seed mixtures for the species-rich grassland and marshy grassland habitats and the pond edge mixtures. Seed sowing can be completed in spring 2025 once earthwork activities have been finished.
- 8.6 The use of plug plants has been recommended to create the reedbed habitat areas and to establish the pond habitats. Within both of these habitats, the project drivers require a rapid vegetation establishment (particularly for the amphibian ponds, which have been designed to provide optimal breeding and egg laying habitat for the great crested newt population which is known to be present on site), and as such 20% of the reedbed and marginal vegetation areas are proposed to be planted with plug plants, representing an increased planting density. In order to achieve the timescales associated with the funding, it is recommended that plug plants are ordered from commercial suppliers by September 2024 at the latest, and that they are planted in spring 2025.
- 8.7 Two different types of woodland are proposed to be established within the Phase 3 land: terrestrial woodland in Areas 1a, 1b and North Field which will be established on the areas where material from the habitat creation works is deposited; and, carr woodland in Areas 1a and 1b which will form part of the wetland / terrestrial habitat mosaic created in these parts of the site. The woodland planting mix for the terrestrial woodland is recommended to be the same as that used for the Green Gates East Nature Reserve project (to be informed by DCC). A proposed planting mix for the carr woodland habitats is provided which includes native black poplar which is currently being grown from local provenance sources, at the Denbighshire Tree Nursery.

8.8 Using the data collected during the assessment works outlined above, a vegetation establishment matrix has been provided which details the potential establishment techniques which could be used at the site at Green Gates Phase 3 to establish the target habitats.

## **8.2 RECOMMENDATIONS**

8.9 Timescales for the project delivery are complicated, with planning permissions, European Protected Species licencing, funding, and protected species presence all to be taken into account and as such, it may be necessary to adapt the strategy set out in this report, should any of these factors significantly change the delivery proposals.

8.10 Great crested newts and reptiles have been recorded using the areas at Green Gates Phase 3 which will be impacted by habitat creation works. In order to ensure minimal disruption to these species, the vegetation establishment methods proposed minimise the time for establishment of the target habitats. Should timescales for the vegetation establishment activities change, consideration will need to be given to the potential impacts of these changes on protected species using the site, and their long-term population impacts.

8.11 Potential biosecurity risks associated with vegetation establishment (including at any donor sites as well as the Green Gates Phase 3 site) must be reviewed prior to establishment works commencing, and risk management control measures must be put in place and adhered to.

8.12 Management of the establishing habitats at the Green Gates Phase 3 site will be critical to ensure that the habitat creation works are successful in achieving the target habitats predicted for the site. A Habitat Management Plan for the Green Gates Phase 3 land has been produced by Biodiversity Advanced Ltd (ref: R-BA197-01).

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