MOTT MACDONALD

Hodder WTW AMP 6 Renovation Project

Botanical Report

21 November 2019

Mott MacDonald
Floor 3
1 Whitehall Riverside
Leeds LS1 4BN
United Kingdom

T +44 (0)113 394 6700
F +44 (0)113 394 6701
mottmac.com

Hodder WTW AMP 6 Renovation Project

Botanical Report

21 November 2019

Issue and Revision Record

Revision	Date	Originator	Checker	Approver	Description
A	31.07.19	M Jaskari	S Jackson	P Renshaw	First Issue
B	21.11.19	S Cottell	N Shelton	P Renshaw	Second Issue following client comments

Document reference: 80040117-01-MMB-HODDE-NA-97-RP-I-0002

Information class: Standard

Contents

Executive summary

Mott MacDonald Ltd was appointed by United Utilities (UU) to undertake a detailed botanical survey of the Stocks Reservoir at the Hodder site. The proposed development will involve increasing the capacity of Stocks Reservoir by raising the level of the overflow weir by 300mm.

A Preliminary Ecological Appraisal (PEA) identified potential sensitive habitats or Habitats of Principal Importance (HPI) within areas to be affected by the works, including inundation vegetation, marshy grassland and wet woodland. A botanical survey was recommended to record any protected, rare or notable plant species known to be present in these habitats. The area around the Stocks Reservoir ('The Site') is designated (non-statutory) as a Biological Heritage Site (BHS). The nearest statutory designated site, North Pennine Dales Meadows SAC (Special Area of Conservation), is 1.3km south of The Site.

This Botanical Report summarises the results of the botanical survey carried out by Mott MacDonald on 3-7 June 2019. Surveyed marshy grassland areas comprised one M23b *Juncus effusus/acutiflorus-Galium palustre* rush-pasture, *Juncus effusus* sub-community, one M22b *Juncus subnodulus-Cirsium palustre* fen-meadow, *Briza media-Trifolium* spp. sub-community, two M27a *Filipendula ulmaria-Angelica sylvestris* mires, *Valeriana officinalis-Rumex acetosa* sub-communities and one M27 *Filipendula ulmaria-Angelica sylvestris* mire. Semi-improved acid grassland areas comprised one U4d *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland, *Luzula multiflora-Rhytidiadelphus loreus* sub-community, one U4e *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland, *Vaccinium myrtillus-Deschampsia flexuosa* sub-community and one U5a *Nardus stricta-Galium saxatile* grassland, species-poor sub-community. One broadleaved semi-natural woodland area consisted of W1 *Salix cinerea-Galium palustre* woodland.

Most surveyed plant communities were relatively species-rich and supported a number of protected, rare or notable species that were known to be present on the Site from previous records and designated site citations. The distribution of the following nine such species was recorded: thread rush *Juncus filiformis*, golden dock *Rumex maritimus*, small water-pepper *Persicaria minor*, water-purslane *Lythrum portula*, shoreweed *Littorella uniflora,* globeflower *Trollius europaeus*, marsh speedwell *Veronica scutellata*, trifid bur-marigold *Bidens tripartite* and creeping willow *Salix repens*.

Mudwort *Limosella aquatica* and orange foxtail *Alopecurus aequalis* were not found.

New Zealand pigmyweed *Crassula helmsii* was widespread and dominated the inundation vegetation forming a dense carpet particularly in the north and east sections of the reservoir. This species is an invasive non-native plant listed on Schedule 9 of The Wildlife and Countryside Act 1981 (as amended).

The proposed plan to increase the capacity of Stocks Reservoir by raising the level of overflow weir by 300mm will increase the maximum water level expected. As water level is also affected by natural fluctuation due to rain fall, the actual water level increase may therefore be less than this. It is thus thought that the reservoir would be full only at times of high rain fall. The increase in the water level would likely result in the loss of some low-lying areas of inundation vegetation supporting protected, rare and notable plant species. However, these species could potentially expand their range towards the rising shoreline. Some of the marshy grassland and wet woodland habitats are likely to flood more often and they may become wetter overall. These habitats and the notable species they support could potentially expand their range to other newly suitable

areas. Those marshy grassland habitats present on steeper elevations may be prone to increasing erosion in their low-lying sections.

Semi-improved acid grassland communities were present on higher ground. However, the banks supporting them showed evidence of erosion or had collapsed. The level of erosion is likely to increase with higher water levels, which would result in losses to the extent of this habitat. This could be partially compensated by moving fences and other barriers delimiting the extent of managed land around the reservoir further away from the reservoir, allowing more diverse semi-natural neutral or acid grassland to develop in acquired areas over time.

Due to the potential erosion to the marshy grassland and semi-improved acid grassland it is recommended that a monitoring plan is put into place by UU to assess this following the works and undertake remedial action if required.

The proposed plan to increase the water level (and size) of the reservoir is likely to expand the distribution of New Zealand pigmyweed towards the shore, where this species could outcompete rare and notable species amongst inundation vegetation. This proposal will not spread this Schedule 9 species to another site (or waterbody), which is prohibited under Schedule 9 of the Wildlife and Countryside Act 1981 (as amended). However, it is recommended that no works that touch the areas of New Zealand pigmyweed are to take place within the River Hodder or Stocks Reservoir in order to prevent the spread of this species. A biosecurity method statement is required for any works within the spillway.

1 Introduction

1.1 Background

1.1.1 Mott MacDonald Ltd was appointed by United Utilities (UU) to undertake a detailed botanical survey of the Stocks Reservoir Zone of Influence (ZoI) at the Hodder site, which is located approximately 2km north-east of Slaidburn in the Forest of Bowland (National Grid Reference of the site SD 71885 54414; see Map in Appendix A). The area around the Stocks Reservoir is hereafter referred to as "the Site" as this includes any areas to which direct or indirect impacts will occur. The Site covers approximately 14ha.

1.1.2 The proposed development comprises an increase to the capacity of Stocks Reservoir by raising the level of the overflow weir by 300mm which will give a top water level of 180.87m above ordinance datum (mAOD). This will be carried out either by using pre-cast coping units or in-situ concrete construction. This will be confirmed during the detailed design stages of the project. Whilst carrying out the works, the reservoir will need to be drawn down to approximately 177.5mAOD. However, the works will be carried out in summer months when water levels are relatively low. The works will take approximately 6-7 weeks to complete.

1.1.3 A Preliminary Ecological Appraisal (PEA) of the site was undertaken initially by Bowland Ecology in 2014. This was followed by a Construction Environmental Management Plan (CEMP) produced by Mott MacDonald Bentley in 2016 (Mott MacDonald Bentley, 2016) to which the findings of the Bowland Ecology PEA are attached. The Environmental Appraisal, completed as part of the CEMP (Mott MacDonald Bentley, 2016), recommended a further PEA (Preliminary Ecological Appraisal) and a detailed botanical survey of the Hodder site.

1.1.4 Some areas of the Site are designated as a Biological Heritage Site (BHS) as part of Lancashire County Heritage Sites (Lancashire County Council, 2019) and are known to support species-rich communities and notable plant species. A number of nationally scarce plant species and species included in the Provisional Lancashire Red data List of Vascular Plants were also known to be present on the Site (Lancashire County Council, 2019).

1.2 Purpose of the botanical survey

1.2.1 The purpose of the botanical survey was to confirm the presence of potential sensitive habitats or Habitats of Principal Importance (HPI) including inundation vegetation, marshy grassland and wet woodland, and to record the location of any protected, rare or notable plant species previously known to be present in these habitats, in order to define appropriate mitigation measures.

1.3 Scope of this report

This report presents the results of the botanical survey and makes recommendations for mitigation measures.

2 Methodology for the survey

2.1 Zone of Influence

2.1.1 The current guidance on ecological assessments (CIEEM, 2018) recommends that all ecological features that occur within a 'zone of influence' (ZoI) for a proposed development are investigated. The ZoI includes:

- Areas directly within the land take for the proposed development and access;
- Areas which will be temporarily affected during construction;
- Areas likely to be impacted by hydrological disruption; and
- Areas where there is a risk of pollution and noise disturbance during construction and/or operation.

2.1.2 The ZoI is variable depending on the ecological receptors affected. With respect to this report it is considered to be all land within the site boundary unless stated otherwise.

2.2 Desk study

2.2.1 A desk study was undertaken of the designated sites for nature conservation, habitats of conservation importance and protected and notable species which occur within 2km of the Site. Data was obtained from the Lancashire Environment Record Network (LERN) as well as relevant publications, reports and online databases. These included the Multi-Agency Geographic Information for the Countryside (MAGIC), Joint Nature Conservation Committee (JNCC) and the Lancashire BAP. Part of the desk study results were adapted from Hodder Preliminary Ecological Appraisal (Mott MacDonald, 2019).

2.3 National Vegetation Classification survey

2.3.1 A National Vegetation Classification (NVC) survey was carried out by botanists from Mott MacDonald on 3-7 June 2019 within the ZoI of Stocks Reservoir. Areas subject to the survey and the NVC communities are shown on the Map in Appendix A.

2.3.2 The Site was surveyed using the following methods based on Rodwell (2006) and Rodwell *et al*. (1991 and 1992):

- Nine habitats were chosen for NVC survey. These communities comprised inundation vegetation, marshy grassland, wet woodland and species-rich acid grassland along the shore of the reservoir subject to erosion. An initial walk over across the habitats of interest was carried out to get a general overview with regards the distribution and structure of the plant communities and flora, and to confirm the requirement for an NVC survey (based on the habitat present and likelihood to support rare and notable species);
- In the eight grassland areas subject to NVC surveys, 2x2m randomly placed vegetation quadrats were used to record species abundance and frequency. The number of quadrats taken in each vegetation stand varied from two to five as some vegetation stands were relatively homogenous or limited in size. In each quadrat, a Domin score (Table 1) for each plant species was recorded. The data was subsequently combined to produce a floristic table for the type of vegetation;

- In the willow carr habitats, 50x50m quadrats were used to record species abundance and frequency in the canopy and sub-canopy layers, and five 4x4m quadrats in the ground flora. In each quadrat, a Domin score (Table 1) for each plant species was recorded and data was subsequently combined to produce a floristic table for the vegetation;
- A complete species list was compiled for each survey area, with relative abundances of the plant species present recorded using the DAFOR scale (Table 2);
- Each vegetation community was described in terms of key species, vegetation structure, management and relationship with neighbouring vegetation; and
- To classify NVC communities, the data was analysed using MAVIS software, which supported manual assigning of each stand of vegetation to a community and sub-community type using community keys, NVC summary descriptions and comparing floristic tables in the NVC Volume 1 (Rodwell *et al.*, 1991), National Vegetation Classification: Field Guide to Woodland (Hall *et al.*, 2004), NVC Volume 2 (Rodwell *et al.*, 1991), NVC Volume 3 (Rodwell *et al*, 1992), and Summary Descriptions of National Vegetation Classification Grassland and Montane Communities (Cooper, 1997).

The nomenclature for the vascular plants in this report follows Stace (2010) for both scientific and English names. The bryophyte nomenclature follows Atherton *et al*. (2010) for scientific names.

Table 1: Assessment of percentage cover using Domin scale.

Domin scale	Percentage cover
10	91-100
9	76-90
8	51-75
7	34-50
6	26-33
5	11-25
4	4-10
3	<4%, many individuals
2	<4%, several individuals
1	<4%, few individuals

Table 2: Assessment of species abundance and frequency using the DAFOR scale.

DAFOR score	Meaning
D	Dominant
A	Abundant
F	Frequent
O	Occasional
R	Rare

2.4 Protected, rare and notable species survey

2.4.1 A search for the location of 11 notable or rare plant species highlighted in BHS designation and former reports (Mott MacDonald Bentley, 2016) was undertaken within the ZoI (both within and outside the areas subject to NVC surveys).

2.4.2 Vascular plant species were checked against “A vascular plant red list for England” Stroh *et al*. (2014), “The Vascular Plant Red Data List for Great Britain” (Cheffings & Farrell, 2006), Schedule 8 of the Wildlife and Countryside Act (WCA) 1981 (as amended) and the list of European protected species of plants in Schedule 5 and in Annex IV(b) of The Conservation of Habitats and Species Regulations 2017 (as amended).

2.5 Invasive plant species survey

2.5.1 A search for any invasive plant species included in Schedule 9 of The Wildlife and Countryside Act (1981) (as amended) was carried out within the ZoI (both inside and outside the areas subject to NVC surveys).

2.6 Limitations of survey methods

2.6.1 Ecological surveys are limited by factors such as time of year, which affects the ability to detect plants. Optimal survey times vary between species and species groups therefore a single survey visit may overlook or under-record certain species. The site survey was undertaken between 3-7 June 2019, which is considered within the optimal time of year for species of woodland, grassland and inundation vegetation and so is considered sufficient for the purposes of this assessment.

2.6.2 The methods involved producing complete species lists and sampling using quadrats of specific survey areas. The results therefore provide a comprehensive list of all species that occur within these areas, but not of all plants across the whole of the Site.

3 Results

3.1 Desk study

3.1.1 There are eight statutory designated sites within 2km. The nearest site is North Pennine Dales Meadows SAC 1.3km south of the site designated for mountain hay meadows. A total of 32 non-statutory designated sites within 2km, two are within the Site which include Stocks Reservoir Biological Heritage Site (BHS) and the River Hodder BHS which may be affected by the works (Mott MacDonald, 2019).

3.2 NVC survey

3.2.1 Overview

3.2.1.1 Habitats surveyed within the ZoI comprise inundation vegetation, marshy grassland, semi-improved acid grassland and broadleaved semi-natural woodland/wet woodland. The results of the NVC survey are presented below. For each area surveyed, a brief description of the structure and species composition is given, along with the NVC classification. A floristic table is presented for each survey area. Scientific and common names are given in the first instance and only common names thereafter. The Map of Stocks Reservoir survey sites and NVC Communities is provided in Appendix A.

3.2.2 NVC Survey Area 1: Marshy grassland

3.2.2.1 Survey Area 1 was located to the east of the final loop of River Hodder before the river meets Stocks Reservoir in the north end of the reservoir. This marshy grassland was classified as NVC Community M23b *Juncus effusus/acutiflorus-Galium palustre* rush-pasture*, Juncus effusus* sub-community (Photographs 1 and 2, Appendix 2). The most abundant species here were soft-rush *Juncus effusus*, tufted hair-grass *Deschampsia cespitosa*, marsh-bedstraw *Galium palustre* and pointed spear-moss *Calliergonella cuspidata*. The number of species recorded per quadrat ranged between 7-12. Sward height was approximately 40-45cm and cover 95-99%. No signs of grassland management were noted. Human impact appeared to be restricted to controlling of the water level in the reservoir. Table 3 below shows the results of the NVC survey.

3.2.2.2 Small water-pepper *Persicaria minor* was present in this community and is classified as Vulnerable on the Vascular Plant Red Data List for Great Britain (Cheffings & Farrell, 2006). It is also included in The Provisional Lancashire Red Data List of Vascular Plants. Tormentil *Potentilla erecta* and common valerian *Valeriana officinalis* are classified as Near Threatened in The Vascular Plant Red List for England (Stroh *et al*. 2014). Golden dock *Rumex maritimus* is included in The Provisional Lancashire Red Data List of Vascular Plants (Lancashire County Council and Lancashire Wildlife Trust, 1988).

Table 3: Summary table for Survey Area 1 with three Quadrats (Q).

Scientific name	Common name	Q 1	Q 2	Q3	DAFOR	Protection and conservation status*
Agrostis stolonifera	Creeping bent	3	-	-	R	-
Angelica sylvestris	Wild angelica	1	1	-	R	-

Scientific name	Common name	Q 1	Q 2	Q3	DAFOR	Protection and conservation status*
Anthoxanthum odoratum	Sweet vernal-grass	-	-	-	R	-
Arrhenatherum elatius	False oat-grass	-	-	-	R	-
Artemisia vulgaris	Mugwort	-	-	-	R	-
Calliergonella cuspidata	Pointed spear-moss	7	3	8	O	-
Cardamine pratensis	Cuckooflower	-	-	-	R	-
Carex ovalis	Oval sedge	-	2	-	R	-
Carex rostrata	Bottle sedge	-	-	-	R	-
Cirsium arvense	Creeping thistle	-	-	-	R	-
Cirsium palustre	Marsh thistle	-	-	-	R	-
Deschampsia cespitosa	Tufted hair-grass	5	2	5	O	-
Epilobium tetragonum	Square-stalked willowherb	-	3	2	R	-
Festuca rubra	Red fescue	-	-	-	R	-
Filipendula ulmaria	Meadowsweet	-	2	-	R/LF	-
Galium palustre	Marsh-bedstraw	3	4	5	O	-
Galium saxatile	Heath bedstraw	3	2	-	R	-
Juncus effusus	Soft-rush	5	5	7	F	-
Luzula multiflora	Heath wood-rush	-	-	-	R	-
Mentha aquatica	Water mint	-	-	-	R	-
Persicaria lapathifolia	Pale persicaria	-	-	-	R	-
Persicaria minor	Small water-pepper	3	5	-	O/LF	Vulnerable (Cheffings & Farrell, 2006)
Phalaris arundinacea	Reed canary-grass	7	5	-	F	-
Potentilla erecta	Tormentil	-	-	-	R	Near Threatened (Stroh *et al.* 2014)
Potentilla anserina	Silverweed	-	-	-	R	-

Scientific name	Common name	Q 1	Q 2	Q3	DAFOR	Protection and conservation status*
Rhytidiadelphus squarrosus	Springy turf-moss	-	-	-	O	-
Rumex acetosa	Common sorrel	-	-	-	R	-
Rumex maritimus	Golden dock	3	-	-	R	-
Rumex obtusifolius	Broad-leaved dock	-	-	-	R	-
Stachys palustris	Marsh woundwort	-	4	-	R	-
Stellaria alsine	Bog stitchwort	-	3	3	R	-
Urtica dioica	Common nettle	-	-	-	R	-
Valeriana officinalis	Common valerian	-	-	-	R	Near Threatened (Stroh *et al.* 2014)
Veronica serpyllifolia	Thyme-leaved speedwell	-	3	-	R	-
Viola palustris	Marsh violet	-	-	5	R	-
BARE GROUND / LEAF LITTER (COVER)	-	5	1	1	R	-
SPECIES PER 2x2m QUADRAT	-	10	14	7	-	-
MEAN HEIGHT (cm) / COVER (%)	-	40 / 95	40 / 99	50 / 99	-	-
ASPECT	-	South-East	South-East	South-East	-	-
SLOPE (º)	-	3	3	3	-	-

Source: Mott MacDonald, 2019. *Vascular plant species were checked against "A Vascular Plant Red List for England" (Stroh *et al.* 2014) and "The Vascular Plant Red Data List for Great Britain" (Cheffings & Farrell, 2006).

3.2.3 NVC Survey Area 2: Semi-improved acid grassland

3.2.3.1 Survey Area 2 was located to the north of Survey Area 1 and to the east of the River Hodder in the north end of the reservoir. This semi-improved acid grassland was classified as NVC Community U4d *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland*, Luzula multiflora-Rhytidiadelphus loreus* sub-community (Photographs 3 and 4, Appendix 2). The most abundant species were sheep fescue *Festuca ovina,* Yorkshire-fog *Holcus lanatus*, heath bedstraw *Galium saxatile*, sweet vernal-grass *Anthoxanthum odoratum* and heath wood-rush *Luzula multiflora*. Common bent *Agrostis capillaris* and little shaggy moss *Rhytidiadelphus loreus*, usually typical of this sub-community, were not recorded. Springy turf-moss *Rhytidiadelphus squarrosus* and pointed spear-moss *Calliergonella cuspidata* were present. The number of species recorded per quadrat ranged between 8-10 per quadrat. Sward height was approximately 20cm and cover 99%. No signs of grassland management or human impact were noted. Table 4 below shows the results of the NVC survey.

3.2.3.2 Tormentil was present in this community and it is classified as Near Threatened in The Vascular Plant Red List for England (Stroh *et al.* 2014).

Table 4: Summary table for Survey Area 2 with two Quadrats (Q).

Scientific name	Common name	Q 1	Q 2	DAFOR	Protection and conservation status*
Anthoxanthum odoratum	Sweet vernal-grass	4	4	O	-
Calliergonella cuspidata	Pointed spear-moss	6	-	O	-
Conopodium majus	Pignut	2	1	R	-
Deschampsia cespitosa	Tufted hair-grass	-	-	R	-
Festuca ovina	Sheep fescue	6	6	F	-
Galium saxatile	Heath bedstraw	5	5	O	-
Holcus lanatus	Yorkshire-fog	7	5	F	-
Hyacinthoides non-scripta	Bluebell	2	-	R	-
Luzula multiflora	Heath wood-rush	5	3	O	-
Nardus stricta	Mat-grass	4	-	R	-
Potentilla erecta	Tormentil	-	4	R	Near Threatened (Stroh *et al.* 2014)
Rhytidiadelphus squarrosus	Springy turf-moss	5	7	F/LA	-
BARE GROUND / LEAF LITTER (COVER)	-	1	1	R	-
SPECIES / 2x2m QUADRAT	-	10	8	-	-
MEAN HEIGHT (cm) / COVER (%)	-	20 / 99	20 / 99	-	-
ASPECT	-	South	East	-	-
SLOPE (º)	-	10	5	-	-

Source: Mott MacDonald, 2019. *Vascular plant species were checked against "A Vascular Plant Red List for England" (Stroh *et al.* 2014) and "The Vascular Plant Red Data List for Great Britain" (Cheffings & Farrell, 2006).

3.2.4 NVC Survey Area 3: Marshy grassland

3.2.4.1 Survey Area 3 was located to the east of Survey Area 2, at the north end of the reservoir. This marshy grassland was classified as NVC Community M22b *Juncus subnodulus-Cirsium palustre* fen-meadow*, Briza media-Trifolium* spp. sub-community (Photographs 5 and 6, Appendix 2). The most abundant species were sheep fescue*,* Yorkshire-fog, sweet vernal-grass, meadow vetchling *Lathyrus pratensis*, common knapweed *Centaurea nigra*, greater

bird's-foot-trefoil *Lotus pedunculatus*, meadowsweet *Filipendula ulmaria*, water mint *Mentha aquatica*, marsh thistle *Cirsium palustre*, quaking-grass *Briza media* and white clover *Trifolium repens*. The number of species recorded per quadrat ranged between 10-14 per quadrat. Sward height was approximately 30cm and cover 99%. This community occurred on the bottom of an approximately 35° steep south-facing slope. No signs of grassland management or human impact were noted. Table 5 below shows the results of the NVC survey.

3.2.4.2 Sneezewort *Achillea ptarmica*, tormentil, quaking-grass and marsh valerian *Valeriana dioica* were present in this community and they are classified as Near Threatened in The Vascular Plant Red List for England (Stroh *et al*. 2014).

Table 5: Summary table for Survey Area 3 with two Quadrats (Q).

Scientific name	Common name	Q 1	Q 2	DAFOR	Protection and conservation status*
GROUND FLORA					
Achillea ptarmica	Sneezewort	3	3	R	Near Threatened (Stroh *et al*. 2014)
Ajuga reptans	Bugle	-	3	R	-
Angelica sylvestris	Wild angelica	1	1	R	-
Anthoxanthum odoratum	Sweet vernal-grass	3	4	R	-
Arrhenatherum elatius	False oat-grass	2	3	R	-
Briza media	Quaking-grass	4	-	R	Near Threatened (Stroh *et al*. 2014)
Caltha palustris	Marsh-marigold	-	2	R	-
Cardamine pratensis	Cuckooflower	-	-	R	-
Carex binervis	Green-ribbed sedge	2	1	R	-
Centaurea nigra	Common knapweed	4	4	R	-
Cerastium fontanum	Common mouse-ear	2	-	R	-
Cirsium arvense	Creeping thistle	-	2	R	-
Cirsium palustre	Marsh thistle	3	1	R	-
Conopodium majus	Pignut	-	-	R	-
Dactylis glomerata	Cock's-foot	-	-	R	-
Dactylorhiza sp.	Orchid sp.	3	-	R	-
Deschampsia cespitosa	Tufted hair-grass	-	-	R	-
Equisetum palustre	Marsh horsetail	-	-	R	-
Festuca ovina	Sheep fescue	4	5	O	-
Festuca rubra	Red fescue	-	3	R	-
Filipendula ulmaria	Meadowsweet	4	6	O/LF	-
Geum rivale	Water avens	-	3	R	-

Scientific name	Common name	Q 1	Q 2	DAFOR	Protection and conservation status*
Holcus lanatus	Yorkshire-fog	5	5	O	-
Juncus effusus	Soft-rush	2	2	R	-
Lathyrus pratensis	Meadow vetchling	5	5	O	-
Lotus pedunculatus	Greater bird's-foot-trefoil	4	4	R	-
Luzula multiflora	Heath wood-rush	2	1	R	-
Lysimachia nemorum	Yellow pimpernel	-	-	R	-
Mentha aquatica	Water mint	3	-	R	-
Nardus stricta	Mat-grass	-	-	R	-
Plantago lanceolata	Ribwort plantain	4	-	R	-
Poa trivialis	Rough meadow-grass	-	1	R	-
Potentilla anserina	Silverweed	-	2	R	-
Potentilla erecta	Tormentil	3	-	R	Near Threatened (Stroh *et al*. 2014)
Primula vulgaris	Primrose	1	-	R	-
Prunella vulgaris	Selfheal	3	-	R	-
Pseudoscleropodium purum	Neat feather-moss	6	4	O/LF	-
Ranunculus acris	Meadow buttercup	-	4	R	-
Ranunculus repens	Creeping buttercup	2	2	R	-
Rhytidiadelphus squarrosus	Springy turf-moss	4	4	O	-
Rumex acetosa	Common sorrel	-	-	R	-
Taraxacum agg.	Dandelion	3	3	R	-
Trifolium repens	White clover	3	-	R	-
Valeriana dioica	Marsh valerian	-	6	R	Near Threatened (Stroh *et al*. 2014)
Veronica chamaedrys	Germander speedwell	3	-	R	-
Vicia sepium	Bush vetch	1	-	R	-
BARE GROUND / LEAF LITTER (COVER)	-	1	1	R	-
SPECIES / 2x2m QUADRAT	-	10	14	-	-

Scientific name	Common name	Q 1	Q 2	DAFOR	Protection and conservation status*
MEAN HEIGHT (cm) / COVER (%)	-	30 / 99	30 / 99	-	-
ASPECT	-	South-East	South	-	-
SLOPE (º)	-	40	35	-	-

Source: Mott MacDonald, 2019. *Vascular plant species were checked against "A Vascular Plant Red List for England" (Stroh et al. 2014) and "The Vascular Plant Red Data List for Great Britain" (Cheffings & Farrell, 2006).

3.2.5 NVC Survey Area 4: Semi-improved acid grassland

3.2.5.1 Survey Area 4 was present to the east of the reservoir approximately 150m north-west of School Lane Car Park. This semi-improved acid grassland was classified as NVC Community U4e *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland, *Vaccinium myrtillus-Deschampsia flexuosa* sub-community (Photographs 7 and 8, Appendix 2). The most abundant species were sheep fescue, Yorkshire-fog, heath bedstraw and tormentil. Wavy hair-grass *Deschampsia flexuosa* was present in two quadrats out of five whereas bilberry *Vaccinium myrtillus* was present only outside the quadrats. Common bent was not recorded. The number of species recorded per quadrat ranged between 8-12 per quadrat. Sward height was approximately 30cm and cover 99%. No signs of grassland management were noted. The south-west margin of this grassland was on a steep eroding bank adjacent to the shore of the reservoir. Table 5 below shows the results of the NVC survey.

3.2.5.2 Sneezewort *Achillea ptarmica*, tormentil, devil's-bit scabious *Succisa pratensis* and heath speedwell *Veronica officinalis* were present within this community and they are classified as Near Threatened in The Vascular Plant Red List for England (Stroh *et al*. 2014).

Table 6: Summary table for Survey Area 4 with five Quadrats (Q).

Scientific name	Common name	Q 1	Q 2	Q 3	Q 4	Q 5	DAFOR	Protection and conservation status*
GROUND FLORA								
Achillea ptarmica	Sneezewort	-	-	-	-	-	R	Near Threatened (Stroh *et al.* 2014)
Calluna vulgaris	Heather	-	-	-	-	-	R	-
Carex hirta	Hairy sedge	1	3	-	-	-	R	-
Carex nigra	Common sedge	4	-	-	2	4	R/LF	-
Carex ovalis	Oval sedge	2	-	2	-	-	R	-
Cirsium palustre	Marsh thistle	-	-	-	-	-	R	-
Deschampsia cesspitosa	Tufted hair-grass	3	-	-	-	-	R	-
Deschampsia flexuosa	Wavy hair-grass	-	-	3	-	5	R	-

Scientific name	Common name	Q 1	Q 2	Q 3	Q 4	Q 5	DAFOR	Protection and conservation status*
Digitalis purpurea	Foxglove	-	-	-	-	-	R	-
Festuca ovina	Sheep fescue	6	6	6	5	5	F	-
Festuca rubra	Red fescue	-	-	-	-	-	R	-
Galium saxatile	Heath bedstraw	6	5	5	5	8	F	-
Holcus lanatus	Yorkshire-fog	4	4	3	5	4	O	-
Hyacinthoides non-scripta	Bluebell	3	4	-	-	-	R	-
Juncus articulatus	Jointed rush	-	-	-	-	-	R	-
Juncus effusus	Soft-rush	-	-	-	3	-	R	-
Lotus pedunculatus	Greater birds-foot-trefoil	-	-	-	-	-	R	-
Luzula multiflora	Heath woodrush	1	3	3	-	1	R	-
Nardus stricta	Mat-grass	4	-	5	-	-	R	-
Pilosella officinarum	Mouse-ear-hawkweed	-	-	-	-	-	R	-
Pleurozium schreberi	Red-stemmed feather-moss	1	5	6	7	5	F/LA	-
Potentilla erecta	Tormentil	5	5	5	5	2	O	Near Threatened (Stroh *et al.* 2014)
Rhytidia-delphus squarrosus	Springy turf-moss	-	-	5	5	6	O/LF	-
Rubus fruticosus	Bramble	-	-	-	-	-	R	-
Rumex acetosa	Common sorrel	-	-	-	-	-	R	-
Succisa pratensis	Devil's-bit scabious	-	-	-	-	-	R	Near Threatened (Stroh *et al.* 2014)
Vaccinium myrtillus	Bilberry	-	-	-	-	-	R	-
Veronica officinalis	Heath speedwell	-	-	-	-	-	R	Near Threatened (Stroh *et al.* 2014)

Scientific name	Common name	Q 1	Q 2	Q 3	Q 4	Q 5	DAFOR	Protection and conservation status*
BARE GROUND / LEAF LITTER (COVER)	-	1	1	1	1	1	R	-
SPECIES / 2x2m QUADRAT	-	12	8	10	8	9	-	-
MEAN HEIGHT (cm) / COVER (%)	-	30 / 99	30 / 99	30 / 99	30 / 99	30 / 99	-	-
ASPECT	-	South-west	South-west	South-west	South-west	South-west	-	-
SLOPE (º)	-	5	3	10	5	2	-	-

Source: Mott MacDonald, 2019. *Vascular plant species were checked against "A Vascular Plant Red List for England" (Stroh *et al*. 2014) and "The Vascular Plant Red Data List for Great Britain" (Cheffings & Farrell, 2006).

3.2.6 NVC Survey Area 5: Broadleaved semi-natural woodland/wet woodland

3.2.6.1 Survey Area 5 was located to the east of the reservoir, approximately 60m west of Hole House Lane. This broadleaved semi-natural woodland was classified as NVC Community W1 *Salix cinerea-Galium palustre* woodland (Photographs 9 and 10, Appendix 2). The woodland canopy was dominated by *Salix cinerea* subsp. *cinerea* with some alder *Alnus glutinosa* and silver birch *Betula pendula*. Canopy mean height was approximately 6m and cover 70%. The understorey comprised only a few grey willow saplings. The ground flora comprised marshy inundation vegetation including thread rush *Juncus filiformis*, marsh bedstraw, greater bird's-foot-trefoil, meadowsweet, water mint, reed canary-grass *Phalaris arundinacea* and tree-moss *Climacium dendroides*. Greater water moss *Fontinalis antipyretica* was present on muddy substrates and on the base of tree trunks. The number of species recorded per quadrat ranged between 6-16 species per quadrat. Ground flora vegetation height was approximately 15-30cm and cover only 50-60%. Bare ground covered 40-50% on a muddy/silty substrate. No signs of woodland management were noted. The margin of the woodland community towards the reservoir supported a lush and dense band of thread rush up to 10m wide. Table 7 below shows the results of the NVC survey.

3.2.6.2 Sneezewort and common valerian were present within this community and they are classified as Near Threatened in The Vascular Plant Red List for England (Stroh *et al*. 2014). Small water-pepper is listed as Vulnerable (Cheffings & Farrell, 2006) in The Vascular Plant Red Data List for Great Britain. Marsh stitchwort *Stellaria palustris* is included in both lists (Cheffings & Farrell, 2006; Stroh et al. 2014). Thread rush is Nationally Scarce and is also included in the Provisional Lancashire Red Data List of Vascular Plants together with shoreweed *Littorella uniflora*.

3.2.6.3 Invasive non-native plant species New Zealand pigmyweed was present amongst the ground flora.

Table 7: Summary table for quadrats in Survey Area 5 with five Quadrats (Q).

Scientific name	Common name	Q1	Q2	Q3	Q4	Q5	DAFOR	Protection and conservation status*
CANOPY								

Scientific name	Common name	Q1	Q2	Q3	Q4	Q5	DAFOR	Protection and conservation status*
Alnus glutinosa	Alder	4	-	-	-	-	R	-
Betula pendula	Silver birch	3	-	-	-	-	R	-
Salix cinerea subsp. *cinerea*	Grey willow	9	-	-	-	-	D	-
SPECIES / 50x50m QUADRAT	-	3	-	-	-	-	-	-
CANOPY MEAN HEIGHT (m) / COVER (%)	-	6 / 70	-	-	-	-	-	-
UNDER-STOREY								
Salix cinerea subsp. *cinerea* sapling	Grey willow sapling	3	-	-	-	-	R	-
SPECIES / QUADRAT 50x50m QUADRAT		1	-	-	-		-	-
UNDER-STOREY MEAN HEIGHT (m) / COVER (%)		2 / 3	-	-	-		-	-
GROUND FLORA								
Achillea ptarmica	Sneezewort	-	-	-	2	-	R	Near Threatened (Stroh *et al.* 2014)
Agrostis stolonifera	Creeping bent	2	2	4	4	-	R	-
Ajuga reptans	Selfheel	-	-	-	-	-	R	-
Angelica sylvestris	Wild angelica	-	-	-	-	-	R	-
Carex elata	Tufted-sedge	-	-	4	3	-	R	-
Carex hirta	Hairy sedge	-	-	-	3	-	R	-
Climacium dendroides	Tree-moss	5	3	5	4	5	O/LF	-
Crassula helmsii	New Zealand pigmyweed	3	-	4	4	4	O	-
Equisetum palustre	Marsh horsetail	-	-	-	-		R	-
Filipendula ulmaria	Meadowsweet	-	-	3	4	3	R	-
Fontinalis antipyretica	Greater water moss	-	4	-	5	4	O	-

Scientific name	Common name	Q1	Q2	Q3	Q4	Q5	DAFOR	Protection and conservation status*
Galium palustre	Marsh bedstraw	3	2	2	3	4	R	-
Hydrocotyle vulgaris	Marsh pennywort	2	-	-	-	-	R	-
Juncus articulatus	Jointed rush	-	-	-	3	-	R	-
Juncus filiformis	Thread rush	7	6	4	-	6	O/LF	-
Littorella uniflora	Shoreweed	2	-	-	-	-	R	-
Lotus pedunculatus	Greater bird's-foot-trefoil	2	-	3	2	2	R	-
Mentha aquatica	Water mint	1	-	3	2	3	R	-
Persicaria lapathifolia	Pale persicaria	-	-	-	-	-	R	-
Persicaria minor	Small water-pepper	-	-	1	-	-	R	Vulnerable (Cheffings & Farrell, 2006)
Phalaris arundinacea	Reed canary-grass	-	-	4	4	4	R	-
Potentilla anserina	Silverweed	4	-	-	-	-	R	-
Potentilla reptans	Creeping cinquefoil	3	-	-	-	-	R	-
Prunella vulgaris	Selfheal	-	-	-	1	-	R	-
Stachys palustris	Marsh woundwort	-	3	-	3	1	R	-
Stellaria palustris	Marsh stitchwort	3	-	-	-	-	R	Vulnerable (Cheffings & Farrell, 2006; Stroh *et al.* 2014)
Valeriana officinalis	Common valerian	-	-	-	3	-	R	Near Threatened (Stroh *et al.* 2014)
Veronica serpyllifolia	Thyme-leaved speedwell	-	-	-	-	-	R	-
Viola palustris	Marsh violet	-	-	-	-	-	R	-
BARE GROUND / LEAF LITTER (COVER)	-	40	40	45	50	40	A	-
SPECIES / 4x4m QUADRAT	-	12	6	11	16	10	-	-
MEAN HEIGHT (cm) / COVER (%)	-	15 / 60	20 / 60	20 / 55	30 / 50	25 / 60	-	-
ASPECT	-	South	South	South	South	South	-	-

Scientific name	Common name	Q1	Q2	Q3	Q4	Q5	DAFOR	Protection and conservation status*
SLOPE (°)	-	3	4	4	4	2	-	-

Source: Mott MacDonald, 2019. *Vascular plant species were checked against "A Vascular Plant Red List for England" (Stroh *et al.* 2014) and "The Vascular Plant Red Data List for Great Britain" (Cheffings & Farrell, 2006).

3.2.7 NVC Survey Area 6: Marshy grassland

3.2.7.1 Survey Area 6 was located to the west of Hole House Lane, south-west of the bridge, and to the south-east of Stocks Reservoir. This marshy grassland was classified as NVC Community M27a *Filipendula ulmaria-Angelica sylvestris* mire, *Valeriana officinalis-Rumex acetosa* sub-community (Photographs 11 and 12, Appendix 2). The most abundant species present were meadowsweet, false oat-grass *Arrhenatherum elatius*, wild angelica *sylvestris*, divided sedge *Carex divisa,* water avens *Geum rivale*, Yorkshire-fog, jointed rush *Juncus* articulates, meadow vetchling, greater bird's-foot-trefoil and common sorrel *Rumex acetosa*. The number of species recorded per quadrat ranged between 7-14 per quadrat. Sward height was approximately 30-40cm and cover 97-99%. No signs of grassland management or human impact were noted. Table 8 below shows the results of the NVC survey.

3.2.7.2 Sneezewort, Devil's-bit-scabious, tormentil and common valerian were present amongst the sward and they are classified as Near Threatened in The Vascular Plant Red List for England (Stroh *et al*. 2014).

Table 8: Summary table for Survey Area 6 with three Quadrats (Q).

Scientific name	Common name	Q 1	Q 2	Q 3	DAFOR	Protection and conservation status*
Achillea ptarmica	Sneezewort	-	1	-	R	Near Threatened (Stroh *et al.* 2014)
Ajuga reptans	Bugle	-	-	-	R	-
Alchemilla vulgaris agg.	Lady's mantle	-	4	-	R	-
Angelica sylvestris	Wild angelica	-	1	3	R	-
Arrhenatherum elatius	False oat-grass	4	4	3	R	-
Caltha palustris	Marsh-marigold	-	-	-	R	-
Cardamine pratensis	Cuckooflower	-	-	1	R	-
Carex divisa	Divided sedge	-	4	4	R	-
Carex hirta	Hairy sedge	-	1	-	R	-
Centaurea nigra	Black knapweed	-	1	-	R	-
Cirsium palustre	Marsh thistle	3	-	-	R	-
Dactylis glomerata	Cock's-foot	-	-	-	R	-
Dactylorhiza sp.	Orchid sp.	-	-	2	R	-

Scientific name	Common name	Q 1	Q 2	Q 3	DAFOR	Protection and conservation status*
Deschampsia cespitosa	Tufted hair-grass	-	-	-	R	-
Equisetum arvense	Field horsetail	-	4	-	R	-
Filipendula ulmaria	Meadowsweet	5	6	5	O	-
Galium palustre	Marsh bedstraw	1	1	-	R	-
Geum rivale	Water avens	-	4	4	R	-
Heracleum sphondylium	Hogweed	-	-	-	R	-
Holcus lanatus	Yorkshire-fog	8	3	-	R/LF	-
Hyacinthoides non-scripta	Bluebell	-	-	-	R	-
Juncus articulatus	Jointed rush	5	3	4	O	-
Juncus inflexus	Hard rush	-	-	5	R	-
Lathyrus pratensis	Meadow vetchling	-	4	3	R	-
Lotus pedunculatus	Greater bird's-foot-trefoil	5	4	4	O	-
Luzula multiflora	Heath bedstraw	-	-	2	R	-
Mentha aquatica	Water mint	-	-	1	R	-
Phalaris arundinacea	Reed canary-grass	-	3	-	R	-
Plantago lanceolata	Ribwort plantain	-	-	-	R	-
Poa trivialis	Rough meadow-grass	2	4	3	R	-
Potentilla erecta	Tormentil	-	-	2	R	Near Threatened (Stroh *et al*. 2014)
Pseudoscleropodium purum	Neat feather-moss	-	3	-	R	-
Ranunculus acris	Meadow buttercup	-	1	1	R	-
Ranunculus repens	Creeping buttercup	1	-	-	R	-
Rumex acetosa	Common sorrel	4	-	3	R	-
Sanguisorba officinalis	Great burnet	-	4	-	R	-
Succisa pratensis	Devil's-bit-scabious	-	-	3	R	Near Threatened (Stroh *et al*. 2014)
Taraxacum agg.	Dandelion	-	-	-	R	-
Thuidium tamariscinum	Common tamarisk moss	-	4	-	R	-
Trifolium repens	White clover	-	-	3	R	-
Valeriana officinalis	Common valerian	3	-	4	R	Near Threatened (Stroh *et al*. 2014)

Scientific name	Common name	Q 1	Q 2	Q 3	DAFOR	Protection and conservation status*
Veronica chamaedrys	Germander speedwell	-	3	-	R	-
Vicia cracca	Tufted vetch	-	-	-	R	-
BARE GROUND / LEAF LITTER (COVER)	-	3	1	1	R	-
SPECIES / 2x2m QUADRAT	-	10	14	7	-	-
MEAN HEIGHT (cm) / COVER (%)	-	30 / 97	35 / 99	40 / 99	-	-
ASPECT	-	East	East	East	-	-
SLOPE (º)	-	3	3	3	-	-

Source: Mott MacDonald, 2019. * Vascular plant species were checked against "A Vascular Plant Red List for England" (Stroh *et al.* 2014) and "The Vascular Plant Red Data List for Great Britain" (Cheffings & Farrell, 2006).

3.2.8 NVC Survey Area 7: Marshy grassland

3.2.8.1 Survey Area 7 was located to the south of the reservoir and south-west of Survey Area 6 and to the west of Hole House Lane. This marshy grassland was relatively similar to Survey Area 6 and was also classified as NVC Community M27a *Filipendula ulmaria-Angelica sylvestris* mire, *Valeriana officinalis-Rumex acetosa* sub-community (Photographs 13 and 14, Appendix 2). The most abundant species present were meadowsweet, reed canary-grass, wild angelica, rough meadow-grass *Poa trivialis*, jointed rush, meadow vetchling, greater bird's-foot-trefoil and common sorrel *Rumex acetosa*. Common feather-moss *Kindbergia praelonga* and springy turf-moss were abundant. The number of species recorded per quadrat ranged between 16-18 per quadrat. Sward height was approximately 35-40cm and cover 99%. No signs of grassland management or human impact were noted. Table 8 below shows the results of the NVC survey.

3.2.8.2 Tormentil and common valerian were present amongst the sward and they are classified as Near Threatened in The Vascular Plant Red List for England (Stroh *et al*. 2014).

Table 9: Summary table for Survey Area 7 with three Quadrats (Q).

Scientific name	Common name	Q 1	Q 2	Q 3	DAFOR	Protection and conservation status*
Ajuga reptans	Bugle	-	-	4	R	-
Anemone nemorosa	Wood anemone	1	-	-	R	-
Angelica sylvestris	Wild angelica	3	3	1	R	-
Arrhenatherum elatius	False oat-grass	3	-	-	R	-
Carex divisa	Divided sedge	-	-	-	R	-

Scientific name	Common name	Q 1	Q 2	Q 3	DAFOR	Protection and conservation status*
Carex hirta	Hairy sedge	-	-	3	R	-
Centaurea nigra	Common knapweed	1	-	-	R	-
Cirsium palustre	Marsh thistle	1	2	-	R	-
Dactylis glomerata	Cock's-foot	-	-	-	R	-
Dryopteris dilatata	Broad buckler-fern	-	-	1	R	-
Dryopteris filix-mas	Male-fern	-	-	-	R	-
Equisetum arvense	Field horsetail	-	-	3	R	-
Equisetum palustre	Marsh horsetail	-	-	-	R	-
Filipendula ulmaria	Meadowsweet	5	6	4	O	-
Galium palustre	Marsh-bedstraw	3	2	-	R	-
Geum rivale	Water avens	-	-	-	R	-
Heracleum sphondylium	Hogweed	-	-	-	R	-
Holcus lanatus	Yorkshire-fog	4	3	3	R	-
Juncus articulatus	Jointed rush	5	5	3	O	-
Juncus effusus	Soft-rush	-	-	-	R	-
Kindbergia praelonga	Common feather-moss	7	7	7	F	-
Lathyrus pratensis	Meadow vetchling	3	-	4	R	-
Lotus pedunculatus	Greater bird's-foot-trefoil	4	4	4	R	-
Phalaris arundinacea	Reed Canary-grass	5	8	4	F	-
Poa trivialis	Rough meadow-grass	4	5	5	O	-
Potentilla erecta	Tormentil	-	-	-	R	Near Threatened (Stroh *et al.* 2014)
Ranunculus ficaria	Lesser celandine	-	-	2	R	-
Rhytidiadelphus squarrosus	Springy turf-moss	3	4	4	R	-
Rubus fruticosus	Bramble	-	-	-	R	-
Rumex acetosa	Common sorrel	3	3	-	R	-

Scientific name	Common name	Q 1	Q 2	Q 3	DAFOR	Protection and conservation status*
Sanguisorba officinalis	Great burnet	4	1	2	R	-
Stachys palustris	Marsh woundwort	-	1	3	R	-
Stellaria holostea	Greater stitchwort	-	-	-	R	-
Trollius europaeus	Globeflower	-	3	-	R	-
Valeriana officinalis	Common valerian	2	3	3	R	Near Threatened (Stroh *et al*. 2014)
Vicia cracca	Tufted vetch	-	-	-	R	-
BARE GROUND / LEAF LITTER (COVER)	-	1	1	1	R	-
SPECIES / 2x2m QUADRAT	-	18	16	18	-	-
MEAN HEIGHT (cm) / COVER (%)	-	40 / 99	35 / 99	40 / 99	-	-
ASPECT	-	North -east	North-east	North-east	-	-
SLOPE (º)	-	15	17	4	-	-

Source: Mott MacDonald, 2019. *Vascular plant species were checked against "A Vascular Plant Red List for England" (Stroh *et al*. 2014) and "The Vascular Plant Red Data List for Great Britain" (Cheffings & Farrell, 2006).

3.2.9 NVC Survey Area 8: Marshy grassland

3.2.9.1 Survey Area 8 was located to the south-east of the fishing lodge to the west of the reservoir. This marshy grassland was classified as NVC Community M27 *Filipendula ulmaria-Angelica sylvestris* mire (Photographs 15 and 16, Appendix 2). The most abundant species present were meadowsweet, wild angelica, soft-rush, meadow vetchling, greater bird's-foot-trefoil and silverweed *Potentilla anserine*, water mint, red fescue *Festuca rubra*, tree-moss and springy turf-moss. The number of species recorded per quadrat ranged between 9-23 per quadrat. Sward height was variable between 15 and 50cm and vegetation cover 70-99%. No signs of grassland management or human impact were noted. Table 8 below shows the results of the NVC survey.

3.2.9.2 Sneezewort, ragget-robin *Lychnis flos-cuculi*, common valerian and marsh speedwell *Veronica scutellata* were present amongst the sward and they are classified as Near Threatened in The Vascular Plant Red List for England (Stroh *et al*. 2014).

3.2.9.3 Invasive non-native plant species, New Zealand pigmyweed, was present amongst the ground flora.

Table 10: Summary table for Survey Area 8 with four Quadrats (Q).

Scientific name	Common name	Q 1	Q 2	Q 3	Q 4	DAFOR	Protection and conservation status
GROUND FLORA							

Scientific name	Common name	Q 1	Q 2	Q 3	Q 4	DAFOR	Protection and conservation status
Achillea ptarmica	Sneezewort	2	-	3	-	R	Near Threatened (Stroh *et al.* 2014)
Ajuga reptans	Bugle	-	-	-	-	R	-
Amblystegium varium	Willow feather-moss	-	-	-	6	R	-
Angelica sylvestris	Wild angelica	-	4	4	-	R	-
Anthoxanthum odoratum	Sweet vernal-grass	-	4	3	-	R	-
Arrhenatherum elatius	False oat-grass	-	-	-	2	R	-
Caltha palustris	Marsh-marigold	-	-	-	-	R	-
Cardamine pratensis	Cuckooflower	1	-	-	-	R	-
Carex acutiformis	Lesser pond-sedge	-	-	7	-	A, LD	-
Carex divisa	Divided sedge	5	-	-	-	R	-
Carex hirta	Hairy sedge	-	-	-	-	R	-
Centaurea nigra	Common knapweed	-	-	4	-	R	-
Cerastium fontanum	Common mouse-ear	-	1	1	-	R	-
Cirsium arvense	Creeping thistle	-	4	5	-	R	-
Cirsium palustre	Marsh thistle	-	-	-	-	R	-
Climacium dendroides	Tree-moss	5	3	-	-	R	-
Crassula helmsii	New Zealand pigmyweed	-	-	-	-	R, LF	-
Dactylis glomerata	Cock's-foot	-	-	-	-	R	-
Deschampsia cespitosa	Tufted hair--grass	-	-	-	5	R	-
Dryopteris filix-mas	Male-fern	-	-	-	-	R	-
Eleocharis palustris	Common spike-rush	5	-	-	-	R	-
Equisetum arvense	Field horsetail	3	-	-	-	R	-
Equisetum palustre	Marsh horsetail	-	-	-	-	R	-
Festuca rubra	Red fescue	-	5	4	-	R	-
Filipendula ulmaria	Meadowsweet	3	6	4	4	O	-
Galium palustre	Marsh-bedstraw	2	3	3	4	R	-

Scientific name	Common name	Q 1	Q 2	Q 3	Q 4	DAFOR	Protection and conservation status
Heracleum sphondylium	Hogweed	-	-	-	-	R	-
Holcus lanatus	Yorkshire-fog	3	-	-	-	R	-
Hypericum tetrapterum	Square-stalked St. John's-wort	-	3	-	-	R	-
Juncus articulatus	Jointed rush	3	-	-	-	R	-
Juncus effusus	Soft-rush	3	-	-	7	O	-
Juncus inflexus	Hard rush	4	-	-	-	R	-
Lathyrus pratensis	Meadow vetchling	-	5	3	-	R	-
Lotus pedunculatus	Greater bird's-foot-trefoil	4	4	-	-	R	-
Luzula multiflora	Heath woodrush	-	-	-	-	R	-
Lychnis flos-cuculi	Ragged-robin	-	3	-	-	R	Near Threatened (Stroh *et al.* 2014)
Mentha aquatica	Water mint	5	3	-	-	R	-
Myosotis scorpioides	Water forget-me-not	4	-	-	-	R	-
Myosotis secunda	Creeping forget-me-not	-	-	4	-	R	-
Persicaria lapathifolia	Pale persicaria	4	-	-	-	R	-
Phalaris arundinacea	Reed canary-grass	-	-	-	5	R	-
Plantago lanceolata	Ribwort plantain	-	-	1	-	R	-
Poa trivialis	Rough meadow-grass	-	-	-	-	R	-
Potentilla anserina	Silverweed	4	4	3	-	R	-
Potentilla reptans	Creeping cinquefoil	-	-	1	-	R	-
Prunella vulgaris	Selfheal	-	-	-	-	R	-
Ranunculus acris	Meadow buttercup	-	4	-	-	R	-
Ranunculus repens	Creeping buttercup	2	-	-	-	R	-
Rhytidiadelphus squarrosus	Springy turf-moss	-	6	5	-	R, LF	-

Scientific name	Common name	Q 1	Q 2	Q 3	Q 4	DAFOR	Protection and conservation status
Rumex acetosa	Common sorrel	-	-	-	-	R	-
Rumex crispus	Curled dock	-	-	-	-	R	-
Rumex obtusifolius	Broad-leaved dock	-	-	-	-	R	-
Rumex sanguineus	Wood-dock	-	-	-	-	R	-
Scrophularia nodosa	Common figwort	-	-	-	-	R	-
Stachys sylvatica	Hedge woundwort	-	-	-	-	R	-
Stellaria alsine	Bog stitchwort	3	-	-	-	R	-
Taraxacum agg.	Dandelion	-	-	2	-	R	-
Trifolium repens	White clover	3	-	-	-	R	-
Tussilago farfara	Colt's-foot	-	-	-	-	R	-
Urtica dioica	Common nettle	-	-	-	3	R	-
Valeriana officinalis	Common valerian	4	5	-	7	O, LF	Near Threatened (Stroh *et al.* 2014)
Veronica beccabunga	Brooklime	4	-	-	-	R	-
Veronica chamaedrys	Germander speedwell	-	-	-	-	R	-
Veronica scutellata	Marsh speedwell	2	-	-	-	R	Near Threatened (Stroh *et al.* 2014)
BARE GROUND / LEAF LITTER (COVER)	-	1	1	30	10	O	-
SPECIES / 2x2m QUADRAT	-	23	17	17	9	-	-
MEAN HEIGHT (cm) / COVER (%)	-	15 / 99	30 / 99	50 / 70	45 / 90	-	-
ASPECT	-	East	East	East	North-east	-	-
SLOPE (º)	-	4	4	4	5	-	-

Source: Mott MacDonald, 2019. *Vascular plant species were checked against "A Vascular Plant Red List for England" (Stroh *et al.* 2014) and "The Vascular Plant Red Data List for Great Britain" (Cheffings & Farrell, 2006).

3.2.10 NVC Survey Area 9: Semi-improved acid grassland

3.2.10.1 Survey Area 9 was located to the west of the reservoir near Eak Hill Wood. This semi-improved acid grassland was classified as NVC Community U5a *Nardus stricta-Galium saxatile* grassland, species-poor sub-community (Photographs 17 and 18, Appendix 2). The most abundant species were mat-grass *Nardus stricta*, sheep fescue, heath bedstraw, tormentil, wavy hair-grass and neat feather-moss *Pseudoscleropodium purum*. The number of species recorded per quadrat ranged between 11-15 per quadrat. Sward height was approximately 30cm and cover 99%. No signs of grassland management were noted. The south-east margin of this grassland was present on top of a steep eroding bank adjacent to the shore of the reservoir. Table 11 below shows the results of the NVC survey.

3.2.10.2 Sneezewort, tormentil and devil's-bit scabious were present within this community and they are classified as Near Threatened in The Vascular Plant Red List for England (Stroh *et al*. 2014).

Table 11: Summary table for Survey Area 9 with two Quadrats (Q).

Scientific name	Common name	Q 1	Q 2	DAFOR	Protection and conservation status*
Achillea ptarmica	Sneezewort	-	2	R	Near Threatened (Stroh *et al*. 2014)
Agrostis capillaris	Creeping bent	-	4	R	-
Ajuga reptans	Bugle	-	-	R	-
Angelica sylvestris	Wild angelica	-	-	R	-
Anthoxanthum odoratum	Sweet vernal-grass	4	4	R	-
Arrhenatherum elatius	False oat-grass	-	-	R	-
Cirsium arvense	Creeping thistle	-	-	R	-
Cirsium palustre	Marsh thistle	-	4	R	-
Dactylorhiza sp.	Orchid sp.	-	-	R	-
Deschampsia cespitosa	Tufted hair-grass	3	-	R	-
Deschampsia flexuosa	Wavy hair-grass	6	7	F	-
Festuca ovina	Sheep fescue	6	5	F	-
Galium saxatile	Heath bedstraw	5	6	F	-
Holcus lanatus	Yorkshire-fog	-	-	R	-
Hyacinthoides non-scripta	Bluebell	-	-	R	-
Juncus articulatus	Jointed rush	-	-	R	-
Juncus conglomeratus	Compact rush	-	3	R	-
Lotus pedunculatus	Greater bird's-foot-trefoil	-	-	R	-
Luzula campestris	Field woodrush	1	-	R	-

Scientific name	Common name	Q 1	Q 2	DAFOR	Protection and conservation status*
Luzula multiflora	Heath wood-rush	3	2	R	-
Luzula multiflora ssp. congesta	Dense-headed heath wood-rush	-	3	R	-
Nardus stricta	Mat-grass	5	5	O	-
Potentilla erecta	Tormentil	5	4	O	Near Threatened (Stroh *et al.* 2014)
Pseudoscleropodium purum	Neat feather-moss	5	6	O	-
Ranunculus repens	Creeping buttercup	-	-	R	-
Rhytidiadelphus squarrosus	Springy turf-moss	4	4	R	-
Rumex acetosa	Common sorrel				-
Succisa pratensis	Devil's-bit scabious	-	3	R	Near Threatened (Stroh *et al.* 2014)
BARE GROUND / LEAF LITTER (COVER)	-	1	1	R	-
SPECIES / 2x2m QUADRAT	-	11	15	-	-
MEAN HEIGHT (cm) / COVER (%)	-	30 / 99	30 / 99	-	-
ASPECT	-	South-East	South-East	-	-
SLOPE (º)	-	10	10	-	-

Source: Mott MacDonald, 2019. *Vascular plant species were checked against "A Vascular Plant Red List for England" (Stroh *et al.* 2014) and "The Vascular Plant Red Data List for Great Britain" (Cheffings & Farrell, 2006).

3.3 Protected, rare and notable plant species

3.3.1 A search for the location of 11 notable or rare plant species highlighted in BHS designation and former reports (Mott MacDonald Bentley, 2016) detected nine species with their locations shown in Table 11 below and on the Map in Appendix 1. Notable or rare plant species comprised Nationally Scarce thread rush (Photograph 20, Appendix 2). Other species included in the Provisional Lancashire Red data List of Vascular Plants were golden dock (Photograph 21, Appendix 2), small water-pepper, water-purslane *Lythrum portula* (Photograph 22, Appendix 2), and shoreweed *Littorella uniflora* (Photograph 23, Appendix 2). Other notable or "sensitive" species (Species listed as sensitive in the Provisional Lancashire Red Data List of Vascular Plants (in Lancashire County Council and Lancashire Wildlife Trust (1988) Biological Heritage Guidelines for Selection) were globeflower *Trollius europaeus* (Photograph 13, Appendix 2), marsh speedwell *Veronica scutellata*, trifid bur-marigold *Bidens tripartite* (Photograph 24, Appendix 2) and creeping willow *Salix repens* (Photograph 25, Appendix 2).

Table 11: Summary table and locations for notable, nationally scarce or sensitive plant species which have led to the site being designated as a BHS.

Scientific name	Common name	Location	Notable/scarce/ sensitive sp.*
Bidens tripartita	Trifid bur-marigold	372502 455915	Notable
Juncus filiformis	Thread rush	Present along the entire shore from 373110 45688 to 373665 456110	Nationally scarce
Juncus filiformis	Thread rush	373617 455863	Nationally scarce
Juncus filiformis	Thread rush	373517 455829	Nationally scarce
Littorella uniflora	Shoreweed	Scattered along the shore from 373277 456217 to 373666 456097	Notable
Littorella uniflora	Shoreweed	372050 455222	Notable
Littorella uniflora	Shoreweed	371968 455269	Notable
Littorella uniflora	Shoreweed	372609 456043	Notable
Littorella uniflora	Shoreweed	372795 456210	Notable
Littorella uniflora	Shoreweed	372726 456150	Notable
Littorella uniflora	Shoreweed	372612 455988	Notable
Littorella uniflora	Shoreweed	372780 455623	Notable
Littorella uniflora	Shoreweed	372078 455426	Notable
Littorella uniflora	Shoreweed	371986 455363	Notable
Lythrum portula	Water-purslane	372048 455251	Notable, Sensitive
Lythrum portula	Water-purslane	372521 455932	Notable, Sensitive
Lythrum portula	Water-purslane	372801 456674	Notable, Sensitive
Lythrum portula	Water-purslane	372801 456674	Notable, Sensitive
Lythrum portula	Water-purslane	372815 456312	Notable, Sensitive
Persicaria minor	Small water-pepper	372637 457028	Notable
Persicaria minor	Small water-pepper	373373 456282	Notable
Rumex maritimus	Golden dock	372704 457079	Notable

Scientific name	Common name	Location	Notable/scarce/ sensitive sp.*
Salix repens	Creeping willow	372672 457061	Notable
Salix repens	Creeping willow	373011 456579	Notable
Salix repens	Creeping willow	373095 456407	Notable
Trollius europaeus	Globeflower	373136 455544	Sensitive
Veronica scutellate	Marsh speedwell	371841 455272	Notable, Sensitive

Source: Mott MacDonald, 2019; *Species listed as sensitive in the Provisional Lancashire Red Data List of Vascular Plants (Lancashire County Council and Lancashire Wildlife Trust (1988) *Biological Heritage Guidelines for Selection*)

3.4 Invasive non-native species

3.4.1.1 Invasive non-native New Zealand pigmyweed was widespread and dominated the inundation vegetation forming a dense carpet particularly in the north and east sections of the reservoir (Photographs 26, 27 and 28, Appendix 2) as illustrated on the Map in Appendix 1. No other invasive non-native species were recorded.

4 Conclusions and recommendations

4.1 Summary of results

4.1.1 Nine vegetation stands were surveyed, comprising marshy grassland, semi-improved acid grassland and broadleaved semi-natural woodland across the inundation vegetation or within a close proximity to it. NVC communities given in Table 11 below included five mires, three acid grassland sites and one wet woodland that included inundation vegetation. Protected, rare and notable plant species were recorded within every NVC community and across the inundation vegetation mainly in the north, east and west of the reservoir. A number of protected, notable or "sensitive" plant species and their locations were recorded both within the assigned NVC communities and elsewhere within the inundation zone.

4.1.2 At the time of the survey the reservoir water level was 3.75m below the maximum level due to low rain fall. This revealed the extent of the inundation vegetation and especially the wide distribution and local dominance of New Zealand pigmyweed within the inundation vegetation across the entire shoreline.

Table 11: Summary table for NVC communities potentially affected by proposed plans.

Survey areas	NVC communities	Habitats/communities under S41 of the NERC Act 2006?	Protected, threatened or notable species found?	Schedule 9 (WCA, 1981) invasive species found?
1	M23b *Juncus effusus/acutiflorus-Galium palustre* rush-pasture, *Juncus effusus* sub-community	No	Yes	No
2	U4d *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland, *Luzula multiflora-Rhytidiadelphus loreus* sub-community	No	Yes	No
3	M22b *Juncus subnodulus-Cirsium palustre* fen-meadow, *Briza media-Trifolium* spp. sub-community	No	Yes	No
4	U4e *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland, *Vaccinium myrtillus-Deschampsia flexuosa* sub-community	No	Yes	No

Survey areas	NVC communities	Habitats/communities under S41 of the NERC Act 2006?	Protected, threatened or notable species found?	Schedule 9 (WCA, 1981) invasive species found?
5	W1 *Salix cinerea-Galium palustre* woodland	Yes (wet woodland)	Yes	New Zealand pigmyweed
6	M27a *Filipendula ulmaria-Angelica sylvestris* mire, *Valeriana officinalis-Rumex acetosa* sub-community	No	Yes	No
7	M27a *Filipendula ulmaria-Angelica sylvestris mire*, *Valeriana officinalis-Rumex acetosa* sub-community	No	Yes	No
8	M27 *Filipendula ulmaria-Angelica sylvestris* mire	No	Yes	New Zealand pigmyweed
9	U5a *Nardus stricta-Galium saxatile* grassland, species-poor sub-community	No	Yes	No

4.2 Recommendations for mitigation

4.2.1 The proposed plan is to increase the capacity of Stocks Reservoir by raising the level of overflow weir by 300mm. This increase is the maximum water level expected, as water level is also affected by natural fluctuation due to rain fall and the actual water level increase may therefore be less than this. It is thus thought that the reservoir would be full only at times of high rain fall.

4.2.2 The impacts of the proposed increase in water level would likely include the loss of some low-lying areas of inundation vegetation supporting protected, rare and notable plant species but in the longer term these species could potentially expand their range towards the rising shoreline.

4.2.3 Some of the marshy grassland habitats (Survey Areas 1, 3, 6, 7 and 8) and wet woodland/willow carr (Survey area 5) are likely to flood more often and they may become wetter overall. These habitats and the notable species they support could potentially expand their range to other newly suitable areas. Those marshy grassland communities present on steeper elevations (Survey Areas 3, 6 and 7) may be prone to increased erosion in their low-lying sections.

4.2.4 Semi-improved acid grassland communities (Survey Areas 2, 4 and 9) were present on higher ground. However, the banks supporting them showed evidence of erosion. Some earth banks

along the River Hodder in the north and Stocks Reservoir margins in the east and west had collapsed, probably due to wave action at the time of high water-level (Photograph 17, Appendix 2). The erosion of the banks supporting acid grassland is likely to increase at the time of higher water level resulting in the losses in the extent of this habitat. This could be partially compensated by moving fences and other barriers delimiting the extent of managed land around the reservoir further away from the reservoir allowing more diverse semi-natural neutral or acid grassland develop in acquired areas over time as recommended in the Bowland Ecology Report (Mott MacDonald Bentley, 2016).

4.2.5 Due to the potential erosion to the marshy grassland and semi-improved acid grassland it is recommended that a monitoring plan is put into place by UU to assess this following the works and undertake remedial action if required.

4.2.6 New Zealand pigmyweed, an invasive plant species listed on Schedule 9 of The Wildlife and Countryside Act 1981 (as amended), was present along the entire shoreline. It also dominated the inundation vegetation in the shallow bays to the north, north-east and east of the reservoir. The proposed plan to increase the water level of the reservoir is likely to expand the distribution of New Zealand pigmyweed towards the shore, where this species could then outcompete rare and notable species amongst inundation vegetation. This proposal is unlikely, however, to cause this species to spread to another site (or waterbody), which is prohibited under Schedule 9 of the Wildlife and Countryside Act 1981 (as amended). This species can spread even from small fragments, for example in boots or wheels of the machinery. It is recommended, therefore, that no works take place within the River Hodder or Stocks Reservoir. A biosecurity method statement is required for any works within the spillway.

References

Atherton, I., Bosanquet, S. and Llawley, M. (Eds.) (2010). *Mosses and Liverworts of Britain and Ireland: A Field Guide*. British Bryological Society.

Chartered Institute of Ecology and Environmental Management (CIEEM) (2018). *Guidelines for Preliminary Ecological Appraisal*. 2nd Edition. Available online at: http://www.cieem.net/data/files/Resource_Library/Technical_Guidance_Series/GPEA/GPEA_April_2017.pdf (Accessed June 2019).

Cheffings, C. and Farrell, L. (Eds.) (2006). *The Vascular Plant Red Data List for Great Britain*. Joint Nature Conservation Committee; Peterborough.

CIEEM (2018). *Guidelines for Ecological Impact Assessment in the UK and Ireland*. Available online at: http://www.cieem.net/data/files/Website_Downloads/Guidelines_for_Ecological_Impact_Assessment_2015.pdf (Accessed June 2019).

Cooper, E.A. (1997). *Summary Descriptions of National Vegetation Classification Grassland and Montane Communities.* JNCC, Peterborough.

DEFRA (2018). Multi-Agency Geographic Information for the Countryside. Available online at: https://magic.defra.gov.uk/ (Accessed June 2019).

Hall, J.E., Kirby, K.J. and Whitbread, A.M. (2004). *National Vegetation Classification: Field Guide to Woodland.* JNCC, Peterborough.

Institute of Environmental Assessment (1995). *Guidelines for Baseline Ecological Assessment.*

Joint Nature Conservation Committee (JNCC) (2010*). Handbook for Phase 1 Habitat Survey: A Technique for Environmental Audit*; Peterborough.

Lancashire County Council (2019). Lancashire County Heritage Sites; Biological Heritage Site; Stocks Reservoir

Mott MacDonald (2019). *Hodder Preliminary Ecological Appraisal*; Leeds.

Mott MacDonald Bentley (2016). *Hodder WTW AMP6 Renovation. 4. Environmental*; Warrington

Natural Environment and Rural Communities (NERC) Act (2006). Available online at: https://www.legislation.gov.uk/ukpga/2006/16/contents Last accessed December 2018 (Accessed December 2018).

Rodwell, J. S. (2006). *National Vegetation Classification: User's Handbook.* JNCC, Peterborough.

Rodwell, J. S. (Ed.), Pigott, C., Ratcliffe, D., Malloch, A., Birks, D., Proctor, M., Shimwell, D., Huntley, J., Radford, E., Wigginton, M. and Wilkins, P. (1991). *British Plant Communities, Volume 1: Woodland and Scrub*. Nature Conservancy Council. Cambridge University Press; Cambridge.

Rodwell, J. S. (Ed.), Pigott, C., Ratcliffe, D., Malloch, A., Birks, D., Proctor, M., Shimwell, D., Huntley, J., Radford, E., Wigginton, M. and Wilkins, P. (1991). British Plant Communities,

Volume 2: Mires and Heaths. Nature Conservancy Council. Cambridge University Press; Cambridge.

Rodwell, J. S. (Ed.), Pigott, C., Ratcliffe, D., Malloch, A., Birks, H., Proctor, M., Shimwell, D., Huntley, J., Radford, E., Wigginton, M. and Wilkins, P. (1992). *British Plant Communities, Volume 3: Grassland and Montane Communities.* Nature Conservancy Council. Cambridge University Press; Cambridge.

Rose, R. (2006). *The Wild Flower Key.* New Revised and Expanded Edition by Clare O'Reilly. Penguin Books Ltd; London.

Stace, C.S. (2010). *New Flora of the British Isles. 3rd Edition*. Cambridge University Press, Cambridge.

Stroh, P., Leach, S., August, T. and Taylor, I. (2014). *A vascular plant red list for England.* Botanical Society of Britain and Ireland; Bristol.

Appendices

A. Map of Stocks Reservoir with NVC communities, and the locations of rare or notable plant species and non-native invasive species.

B. Photographs

Photograph 1: Survey Area 1, Quadrat 1 with M23b *Juncus effusus/acutiflorus-Galium palustre* rush-pasture, *Juncus effusus* sub-community.

Photograph 2: Survey Area 1 with M23b *Juncus effusus/acutiflorus-Galium palustre* rush-pasture, *Juncus effusus* sub-community.

Photograph 3: Survey Area 2, Quadrat 2 with U4d *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland, *Luzula multiflora-Rhytidiadelphus loreus* sub-community.

Photograph 4: Survey Area 2 with U4d *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland, *Luzula multiflora-Rhytidiadelphus loreus* sub-community.

Photograph 5: Survey Area 3 with M22b *Juncus subnodulus-Cirsium palustre* fen-meadow, *Briza media-Trifolium* spp. sub-community.

Photograph 6: Survey Area 3, Quadrat 1 with *M22b Juncus subnodulus-Cirsium palustre* fen-meadow, *Briza media-Trifolium* spp. sub-community.

Photograph 7: Survey Area 4, Quadrat 1 with U4e *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland, *Vaccinium myrtillus-Deschampsia flexuosa* sub-community.

Photograph 8: Survey Area 4, Quadrat 5 with U4e *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland, *Vaccinium myrtillus-Deschampsia flexuosa* sub-community.

Photograph 9: Survey Area 5, Quadrat 1 with W1 *Salix cinerea-Galium palustre* woodland.

Photograph 10: Survey Area 5 canopy within W1 *Salix cinerea-Galium palustre* woodland.

Photograph 11: Survey Area 6, Quadrat 3 with M27a *Filipendula ulmaria-Angelica* sylvestris mire, *Valeriana officinalis-Rumex acetosa* sub-community.

Photograph 12: Survey Area 6 with M27a *Filipendula ulmaria-Angelica sylvestris* mire, *Valeriana officinalis-Rumex acetosa* sub-community.

Photograph 13: Survey Area 7, Quadrat 2 with M27a *Filipendula ulmaria-Angelica sylvestris* mire, *Valeriana officinalis-Rumex acetosa* sub-community. Globeflower was present within this community.

Photograph 14: Survey Area 7 with M27a Filipendula ulmaria-Angelica sylvestris mire, Valeriana officinalis-Rumex acetosa sub-community.

Photograph 15: Survey Area 8, Quadrat 1 with M27 *Filipendula ulmaria-Angelica sylvestris* mire.

Photograph 16: Survey Area 8 with M27 *Filipendula ulmaria-Angelica sylvestris* mire.

Photograph 17: Survey Area 9, Quadrat 2 with U5a *Nardus stricta-Galium saxatile* grassland, species-poor sub-community.

Photograph 18: Survey Area 9 with U5a *Nardus stricta-Galium saxatile* grassland, species-poor sub-community.

Photograph 19: Survey Area 9. The bank supporting semi-improved acid grassland in Survey Area 9 has eroded and collapsed.

Photograph 20: Nationally scarce thread rush was present along Stocks Reservoir shore to the east forming a band along willow carr.

Photograph 21: Golden dock was present amongst marshy grassland in Survey Area 1.

Photograph 22: Water-purslane was present amongst the inundation vegetation along the west shore of Stocks Resrevoir.

Photograph 23: Shoreweed was present amongst the inundation vegetation along the west and central east shoreline of the reservoir.

Photograph 24: Trifid bur-marigold was present along the central west shore of the reservoir.

Photograph 25: Creeping willow present in the north and central west section along the reservoir shore. 	Photograph 26: New Zealand pigmyweed was abundant amongst the inundation vegetation in the north of the reservoir. 
Photograph 27: New Zealand pigmyweed on the west shore of the reservoir. 	Photograph 28: New Zealand pigmyweed forming a dense carpet dominating the inundation vegetation on the north-west shore of the reservoir. 

mottmac.com