

Ove Arup and Partners

Stephenson Street Embankment, Newport

Vegetation survey



September 2018

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Cover photographs: Left: Saltmarsh fringe, looking upstream towards Transporter Bridge; Right: Marsh Mallow.

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1. Introduction

Ove Arup and Partners have commissioned Sturgess Ecology to undertake a vegetation survey along part of the bank of the tidal section of the river Usk in Newport (approximate central grid reference SN985039). The site is proposed for flood defence works and this study is being carried out as part of a range of ecological surveys which are being undertaken on the site.

This report presents an outline of the survey methodology and summarises the findings through a series of vegetation descriptions and target notes.

The study area comprises mainly saltmarsh, fringed by scrub and disturbed land. The boundary is shown on an aerial photograph background in Figure 1.

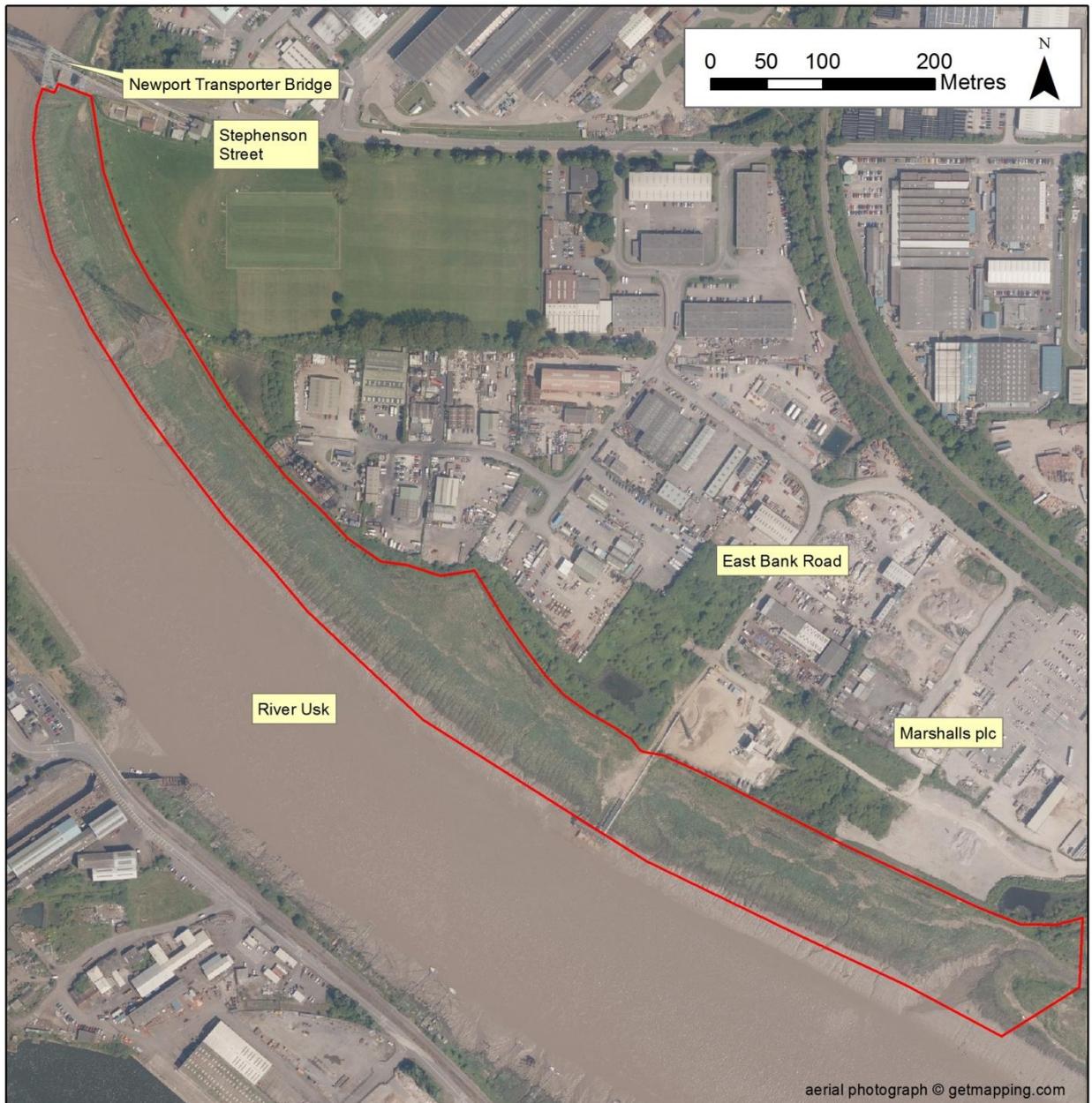


Figure 1. Overview of study area

2. Survey method

The objective of the study was to map and describe the plant communities within the site using National Vegetation Classification (NVC) methods.

The fieldwork and assessment were undertaken by Dr Peter Sturgess CEnv MCIEEM. He is an experienced botanist and familiar with the NVC.

The survey work was carried out on 15 August 2018. The weather was dry, following earlier rain, and considered ideal for this type of survey.

The survey was mainly undertaken using a simple walk-through method, walking the site to examine and map the various vegetation types. The plant communities were plotted by eye onto an aerial photograph base plan. Photographs were also taken to illustrate the main vegetation types.

The vegetation was delineated into approximately homogeneous stands for mapping purposes. These mostly coincide with the broad habitats and therefore the mapping has attempted to use similar map colouring to standard JNCC habitat survey methodology (JNCC, 2010). The plant communities were described in terms of the published NVC communities (Rodwell, 1991, etc.) through the use of quadrat sampling and target notes.

A total of 45 quadrats were recorded. These involved recording every species within square 2x2m sample areas. These quadrat areas were generally selected as being representative samples of the stand in which they occurred. The cover of every species within each quadrat was assessed using the Domin scale, as shown in Table 1. An estimate was also made of the percentage cover by vegetation and the approximate vegetation height (as an average through the quadrat).

Table 1. Domin scale for recording vegetation cover

Percentage cover	Domin score
91-100%	10
76-90%	9
51-75%	8
34-50%	7
26-33%	6
11-25%	5
4-10%	4
<4% - many individuals	3
<4% - several individuals	2
<4% - few individuals	1
Associate species (within 1m of a quadrat)	A

The quadrats recorded from each similar plant community were grouped together into floristic tables, giving each distinct community its own table. Following NVC methodology, the occurrence of each species within the group of quadrats was assigned a constancy score as indicated in Table 2. The species within each table were then listed in order of their constancy score. Once the tables were completed, they were compared with the communities within the published NVC classification. In this case, all comparisons have been made on the basis of the author's experience, rather than use of any analytical software.

Table 2. Constancy scores for quadrat data

Frequency within quadrats	Constancy Score
81 - 100%	V
61 - 80%	IV
41 - 60%	III
21 - 40%	II
1 - 20%	I
Associate species (A) only	

The timing of the survey in August is ideal for botanical study. However, a period of unusually hot and dry weather had resulted in some species finishing flowering earlier in the season than usual, so it is possible that some early-flowering plants may have been overlooked, or may be under-represented in the findings. Limited access to some habitats may have affected the results. In particular, tall reeds and the dense Bramble scrub along the upper shore were harder to access than the grassland habitats. Also, several large areas of vegetation were difficult to assess due to extensive deposits of tidal debris.



Saltmarsh vegetation obscured by tidal debris.

3. Survey findings

A list of the plant species recorded during the survey is presented in Appendix 1, which includes the scientific and common names for each species.

The vegetation mapping is presented in Figure 2. These broadly show the main blocks of different vegetation types, overlaid on an aerial photograph to provide a context for the observations. The vegetation stands have been plotted by eye and do not always have clearly defined boundaries, so they should only be considered very approximate. For example, the large patches of Sea Couch merge gradually into most of the other habitats. In addition, the communities at the seaward edge of the saltmarsh were too complex to map accurately due to the numerous patches of Cordgrass, so these have been mapped as a mosaic of the two main community types. Notes on the variations and mosaics seen are included in the subsequent plant community descriptions. In a few cases the plant communities have been described as target notes rather than by using quadrats.

The locations of the quadrats and target notes are shown in Figure 2. Where possible, quadrats were sampled from communities dispersed widely across the site to give an indication of the range of variation within each community and across the site. However, they are not completely representative because in some cases they were chosen to highlight the full range of species within a community (e.g. Quadrat 4 was chosen to identify the position of the locally notable Marsh Mallow, and to show the plants associated with it).

The vegetation descriptions and constancy tables are presented below. They attempt to describe the vegetation in terms of the published NVC communities. In some cases it has not been possible to match the vegetation with the published types very precisely, particularly where the plant communities have been subject to disturbance or where they are in a state of transition. The community descriptions are presented together with the quadrat data collected, arranged as NVC vegetation tables. The species in the tables are arranged in order of frequency, as denoted by the constancy score in the right-hand column.

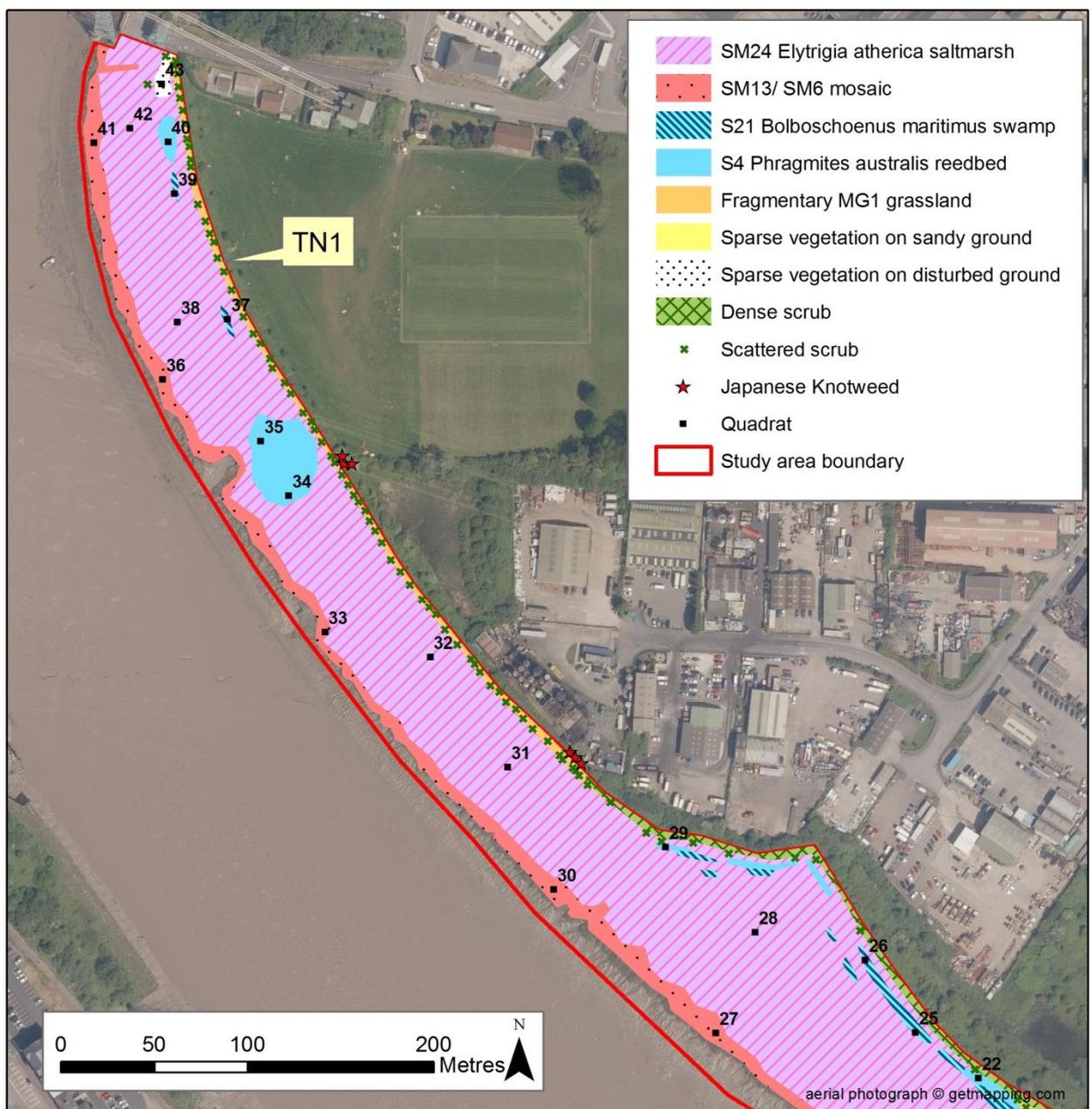


Figure 2a. Vegetation plan, northern part.

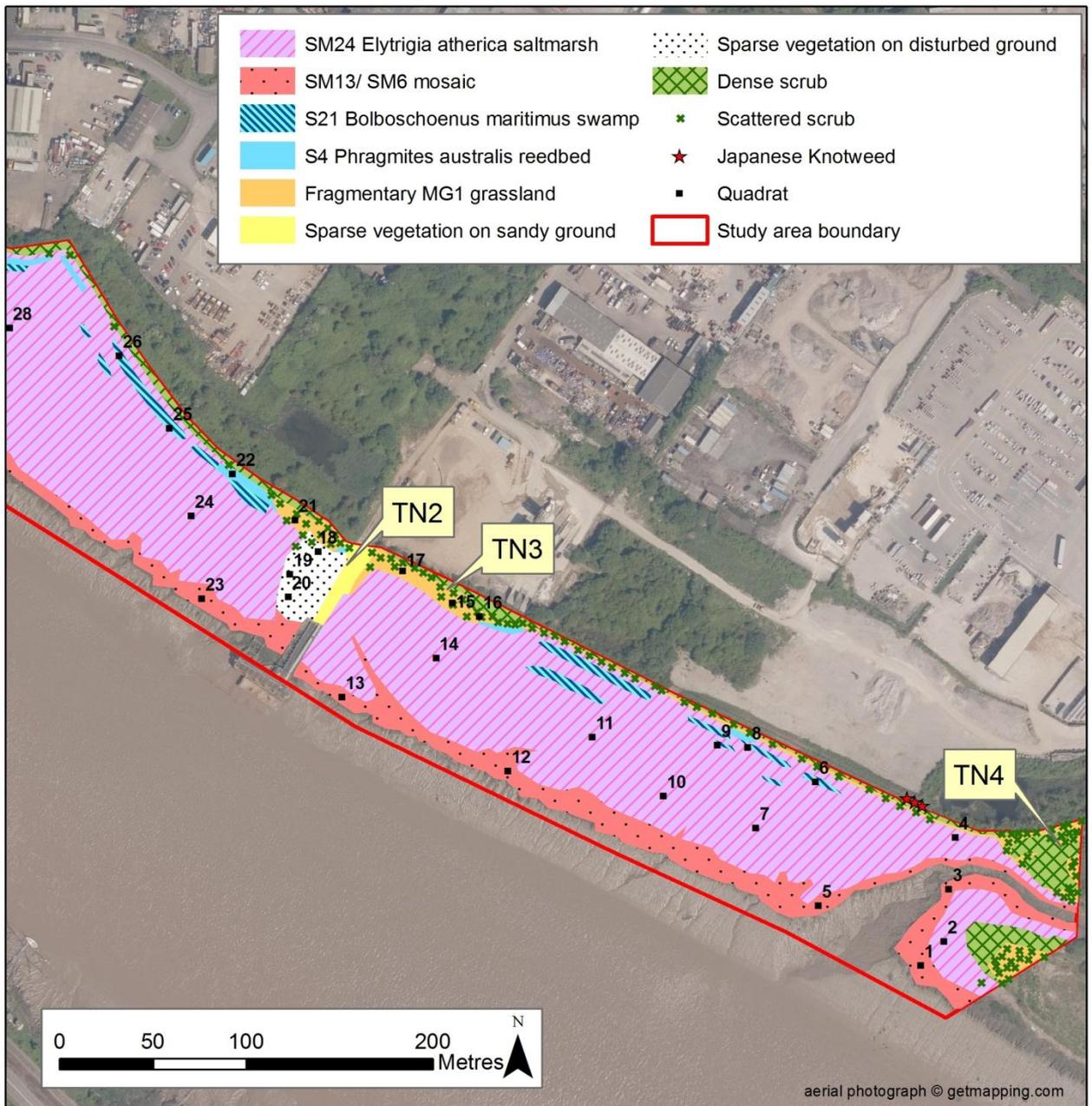


Figure 2b. Vegetation plan, southern part.

SM24 Elytrigia atherica saltmarsh

The majority of the study area supports a wide belt of Sea Couch. This is typically a very low diversity sward, often with no associated species. The most frequent associate is Spear-leaved Orache, which occurs sparsely through this community. Scattered plants of Common Reed are also present in a few places. The vegetation height reflected in the quadrata data is probably much lower than might normally be expected for this community, but this was due to much of the vegetation having been flattened by recent high tides.

At the top edge of the upper shore, the SM24 community merges into the scrub and rough HG1 grassland on the embankment. Dittander is present along several parts of this transitional edge. One quadrat was recorded along the upper shore edge, to illustrate the community associated with Marsh Mallow. Only two plants of Marsh Mallow were found, and both of these were in the vicinity of Quadrat 4.

The structural uniformity of the community is locally broken up by lines of driftwood and other debris deposited by high tides, but the presence of this material does not appear to affect the species composition. (Where material has been moved by heavy machinery near the top of the shore, the resulting disturbance has influenced the vegetation, and these areas are described under the S21 community.)

Table 3. Quadrat data for SM24 saltmarsh

Species	2	4	7	11	14	24	28	31	32	38	42	Frequency
<i>Elytrigia atherica</i>	10	10	10	10	10	10	10	10	10	10	10	V
<i>Atriplex prostrata</i>	2		1		A		1				A	I
<i>Althaea officinalis</i>		1										I
<i>Beta vulgaris</i>		A										
<i>Lepidium latifolium</i>		A										
<i>Phragmites australis</i>								A				
<i>Rubus fruticosus</i>		A										
<i>Sonchus arvensis</i>				A							A	
Total species	2	2	2	1	1	1	2	1	1	1	1	
Cover (%)	100	100	100	100	100	100	100	100	100	100	100	
Average sward height (cm)	40	60	60	60	70	50	40	50	50	40	40	

*SM24 saltmarsh.*

Mosaic of SM13 Puccinellia maritima saltmarsh / SM6 Spartina anglica saltmarsh margin on lower shore

The lowest part of the saltmarsh comprises a patchy mix of Sea Aster, Common Saltmarsh Grass, Annual Sea-blite and Common Cord-grass, forming a fringe between the steeply sloping bare mud banks of the Usk and the Sea Couch community. The Common Cord-grass tends to form dense species-poor patches, usually only a few metres wide but sometimes extending for tens of metres along the shore. The Common Salt-marsh Grass and Sea Aster are associated with a slightly more diverse community. This habitat mosaic is mostly confined to the lower shore but narrow bands also extend for a short distance further up, following the boundaries of steep-sided gullies.

The SM13 community near to the small creek at the eastern end of the study area appeared to be the most diverse part, with a relatively high proportion of Sea Milkwort, Sea Arrow-grass and Greater Sea Spurrey. The highest proportion of Common Cord-grass was seen in the southernmost third of the study area, but not much of it was present in the creek.

Table 4. Quadrat data for SM13/ SM6 saltmarsh mosaic

Species	1	3	5	8	12	13	23	27	30	33	36	41	Frequency
<i>Aster tripolium</i>	8	5	5	4	4	7	1	8	5	6	4	6	V
<i>Puccinellia maritima</i>	6	4	5	10	4	10	6	8	9	9	9	8	V
<i>Suaeda maritima</i>	5	1	A	1	2	2	2	1	4	3	1	A	V
<i>Atriplex prostrata</i>	2	4			A	1	7	2	2	5	A		III
<i>Elytrigia atherica</i>		2	A			A	A	1	2	4	A	4	III
<i>Spartina anglica</i>	2	6	8	2	10	A		A	1	A	4		III
<i>Cochlearia anglica</i>									1				I
<i>Glaux maritima</i>		5											I
<i>Triglochin maritimum</i>		4											I
<i>Beta vulgaris</i>					A								
<i>Plantago maritima</i>									A				
<i>Spergularia media</i>		A											
Total species	5	8	3	4	4	4	4	5	7	5	4	3	
Cover (%)	95	90	95	100	90	95	95	95	95	95	95	95	
Average sward height (cm)	40	50	90	30	70	30	40	50	30	40	40	50	



SM13 *Puccinellia maritima* saltmarsh.



SM13 *Puccinellia maritima* saltmarsh with dense patches of SM6 *Spartina anglica* saltmarsh.

S21 *Bolboschoenus maritimus* swamp

Several shallow, linear, tidal pools are present near the top of the saltmarsh (some of them possibly resulting from vehicle access during maintenance works near the flood embankment). They are mostly dominated by Sea Clubrush, but they also contain a patchy mix of other saltmarsh species, including Saltmarsh Rush, Sea Milkwort, Annual Seablite, Sea Aster and Common Saltmarsh Grass (which give some resemblance to the SM13 vegetation of the lower shore). A large clump of Long-bracted Sedge was also noted beside one of the pools. The pools are distinct from the dense SM24 community that surrounds them, but due to their narrow width Sea Couch is a constant species in the quadrat data.

Table 5. Quadrat data for S21 *Bolboschoenus maritimus* swamp

Species	6	9	10	25	26	37	39	Frequency
<i>Bolboschoenus maritimus</i>	8	3		10	1	9	8	V
<i>Elytrigia atherica</i>	A	4	5	1	5	8	8	V
<i>Atriplex prostrata</i>		1	1	2	5		2	IV
<i>Glaux maritima</i>	4	4			4			III
<i>Juncus gerardii</i>		2	7		5		4	III
<i>Festuca rubra</i>	1	4						II
<i>Lepidium latifolium</i>	2	A			1			II
<i>Triglochin maritimum</i>	A	2	4					II
<i>Aster tripolium</i>		A	2					I
<i>Beta vulgaris</i>						1	A	I
<i>Carex extensa</i>					1			I
<i>Oenanthe crocata</i>					1			I
<i>Phragmites australis</i>		2						I
<i>Ranunculus sceleratus</i>		1						I
<i>Sonchus oleraceus</i>					1			I
<i>Spergularia marina</i>	2							I
<i>Suaeda maritima</i>			1					I
<i>Tripleurospermum inodorum</i>	1							I
<i>Carex otrubae</i>	A	A						
<i>Chenopodium rubrum</i>	A							
<i>Plantago coronopus</i>	A							
<i>Sonchus arvensis</i>	A						A	
<i>Sonchus asper</i>						A		
Total species	6	9	6	3	9	3	4	
Cover (%)	60	70	50	95	90	100	100	
Average sward height (cm)	100	100	40	100	90	100	90	



S21 *Bolboschoenus maritimus* swamp vegetation in upper part of the saltmarsh.

S4 Phragmites australis reedbed

Common Reed is present as occasional scattered plants in several parts of the upper saltmarsh, but in a few places it forms dense and extensive stands. These dense patches of reed are very species-poor, and the few associated species are mainly limited to sparse remnants of Sea Couch and Spear-leaved Orache at the reedbed margins.

Table 6. Quadrat data for S4 *Phragmites australis* reedbed

Species	Quadrat	22	29	34	35	40	Frequency
<i>Phragmites australis</i>		10	10	10	10	10	V
<i>Atriplex prostrata</i>		A	1			2	II
<i>Elytrigia atherica</i>		1	2				II
<i>Rubus fruticosus</i>			A				0
<i>Buddleja davidii</i>			A				0
Total species		2	3	1	1	2	
Cover (%)		100	100	100	100	100	
Average sward height (cm)		160	170	190	200	220	



S4 *Phragmites australis* reedbed.

Open vegetation communities on disturbed ground

Two areas of disturbed ground support sparse, patchy vegetation characterised by ruderal plants, particularly Scentless Mayweed, Scarlet Pimpernel and Creeping Bent. The largest area is located near the conveyor belt at TN2. The vegetation do not conform readily to any published NVC communities, but appears closest to OV19 *Poa annua* - *Tripleurospermum inodorum* community and OV28 *Agrostis stolonifera* - *Ranunculus repens* community. The presence of sand spilling from the conveyor also gives some parts of that area resemblance to sand-dune vegetation, especially with patchy Restharrow, Biting Stonecrop and Thyme-leaved Sandwort. Dittander is locally frequent near the conveyor. Another locally uncommon species Narrow-leaved Everlasting Pea occurs in small quantity near the upper shore.

Towards the seaward margin the disturbed vegetation is a sparse assemblage of more typical saltmarsh plants, including Sea Mayweed, Sea Milkwort, Spear-leaved Orache and Sea Couch. The disturbed ground near the upper shore supports the greatest range of species, and this grades into a denser, more grassy sward described under MG1 grassland.

Table 7. Quadrat data for open vegetation areas

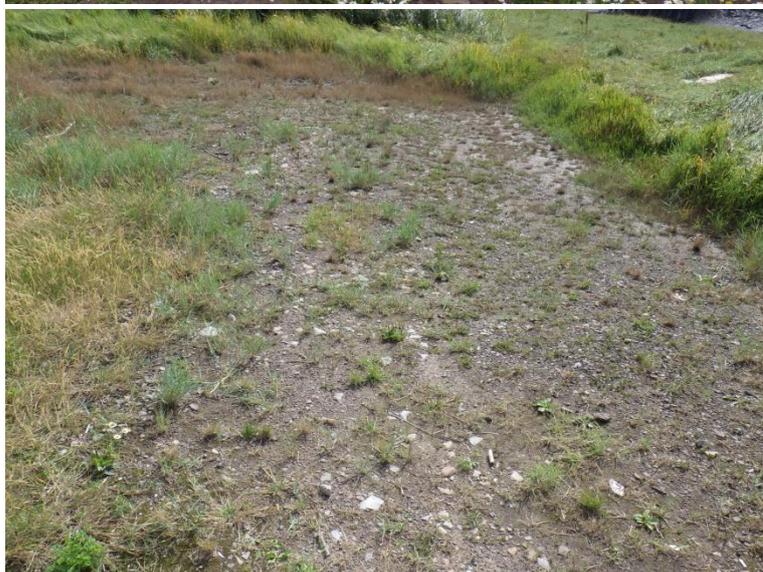
Species	18	19	20	43	Frequency
<i>Anagallis arvensis</i>	3	1	4		IV
<i>Tripleurospermum inodorum</i>	4	3	2	A	IV
<i>Agrostis stolonifera</i>	A	2		4	III
<i>Coryza floribunda</i>	1	3			III
<i>Hirschfeldia incana</i>	1	3			III
<i>Holcus lanatus</i>	1	1			III
<i>Hypericum perforatum</i>	2	1			III
<i>Pastinaca sativa</i>	1	1			III
<i>Potentilla anserina</i>	1	A	6		III
<i>Aster tripolium</i>				1	II
<i>Atriplex prostrata</i>			A	1	II
<i>Bellis perennis</i>	1				II
<i>Cirsium arvense</i>		1		A	II
<i>Elytrigia atherica</i>				1	II
<i>Oenothera cf biennis</i>	1				II
<i>Ononis repens</i>	A	6			II
<i>Plantago coronopus</i>	1	A			II
<i>Plantago major</i>	2				II
<i>Polygonum aviculare</i>				2	II
<i>Potentilla reptans</i>	A	2			II
<i>Ranunculus repens</i>	1	A			II
<i>Rubus fruticosus</i>	1	A			II
<i>Rumex crispus</i>		1			II
<i>Sonchus arvensis</i>			1		II
<i>Spergularia marina</i>				3	II
<i>Taraxacum sp.</i>	1				II
<i>Tripleurospermum maritimum</i>			4		II
<i>Beta vulgaris</i>				A	
<i>Carex otrubae</i>				A	
<i>Daucus carota</i>				A	
<i>Epilobium parviflorum</i>	A				
<i>Juncus inflexus</i>	A				
<i>Lycopus europaeus</i>	A				
<i>Persicaria amphibia</i>				A	
<i>Phalaris canariensis</i>			A		
<i>Picris echioides</i>			A		
<i>Senecio vulgaris</i>			A		
<i>Sonchus asper</i>				A	
<i>Sonchus oleraceus</i>			A		
<i>Verbena officinalis</i>	A				
Total species	15	12	5	6	
Cover (%)	15	50	60	20	
Average sward height (cm)	5	10	10	5	

A number of plants occurring at low density on disturbed ground in the vicinity of TN2 did not fall within the quadrats. These included the following:

<i>Plantago lanceolata</i>	<i>Galeopsis</i> sp (seedling)
<i>Lepidium latifolium</i>	<i>Myosotis arvensis</i>
<i>Dipsacus fullonum</i>	<i>Bolboschoenus maritimus</i>
<i>Buddleja davidii</i>	<i>Sison amomum</i>
<i>Alnus glutinosa</i> (sapling)	<i>Eupatorium cannabinum</i>
<i>Lathyrus sylvestris</i>	<i>Glaux maritima</i>
<i>Prunella vulgaris</i>	<i>Carex hirsuta</i>
<i>Crataegus monogyna</i> (sapling)	<i>Leucanthemum vulgare</i>
<i>Sedum acre</i>	<i>Arenaria serpyllifolia</i>
<i>Homalothecium lutescens</i>	<i>Chenopodium rubrum</i>
<i>Didymodon insulanus</i>	<i>Odontites vernus</i>
<i>Pulicaria dysenterica</i>	<i>Leycesteria formosa</i>
<i>Hedera helix</i>	<i>Crepis capillaris</i>
<i>Cirsium vulgare</i>	<i>Phragmites australis</i>
<i>Brachythecium rutabulum</i>	<i>Veronica persica</i>
<i>Rosa canina</i>	



Open vegetation on disturbed ground at TN2, with abundant Scentless Mayweed.



Small patch of disturbed ground at Quadrat 43, with little vegetation other than sparse Creeping Bent.

Fragmentary MG1 Arrhenatherum elatius grassland

An area of rough grass and scrub at the top of the shoreline at TN3, that appears to be above the general level of the saltmarsh but below the top of the embankment height. It was described as an area of 'recently cleared ground' during a vegetation survey carried out during 2014 so the vegetation has re-established in less than 4 years. The flora includes a mix of typical coarse grassland species and plants more typical of ruderal communities, reflecting its transitional nature. One notable plant was a large bushy Restharrow that was very spiny; however, the leaf and stem characters showed that it was not Spiny Restharrow. It is probably either a fertile hybrid, or the spiny form of Common Restharrow *Ononis repens* var *horrida*. Other species of local interest were several plants of Stone Parsley, and Bee Orchid, which was identified from a seed-head.



*Fragmentary MG1
Arrhenatherum elatius
grassland, with scattered
Bramble and Hawthorn scrub.*



*Fringe of coarse fragmentary
MG1 Arrhenatherum elatius
grassland and scrub at TN3.*

Table 8. Quadrat data for fragmentary MG1 *Arrhenatherum elatius* grassland

Species	15	16	17	21	Frequency
<i>Arrhenatherum elatius</i>	4	8	5	6	V
<i>Festuca rubra</i>	5	3	5	2	V
<i>Rubus fruticosus</i>	5	2	2	4	V
<i>Cirsium arvense</i>		2	1	1	IV
<i>Elytrigia atherica</i>	4	3	5	A	IV
<i>Medicago lupulina</i>	2		3	2	IV
<i>Pastinaca sativa</i>	1	1	A	4	IV
<i>Senecio erucifolius</i>	A	2	1	2	IV
<i>Torilis japonica</i>	1	2	2		IV
<i>Agrostis stolonifera</i>			5	6	III
<i>Coryza floribunda</i>	A		2	2	III
<i>Dactylis glomerata</i>			2	2	III
<i>Dipsacus fullonum</i>	1	A	1	A	III
<i>Hypericum perforatum</i>	2			2	III
<i>Picris echioides</i>		2	2		III
<i>Sison amomum</i>		1	2		III
<i>Carex hirta</i>				2	II
<i>Carex otrubae</i>			2		II
<i>Centaurium erythraea</i>			2		II
<i>Cerastium fontanum</i>				1	II
<i>Clematis vitalba</i>	4				II
<i>Crataegus monogyna</i>	1	A	A		II
<i>Galium mollugo</i>	4				II
<i>Hedera helix</i>	6				II
<i>Holcus lanatus</i>				4	II
<i>Homalothecium lutescens</i>				1	II
<i>Lepidium draba</i>			1		II
<i>Leucanthemum vulgare</i>	5				II
<i>Ophrys apifera</i>	1				II
<i>Poa trivialis</i>	2				II
<i>Prunella vulgaris</i>				2	II
<i>Rosa canina</i>	A	1	A	A	II
<i>Rumex crispus</i>		2			II
<i>Solanum dulcamara</i>			1		II
<i>Sonchus arvensis</i>		1			II
<i>Thuidium tamariscinum</i>	4				II
<i>Tripleurospermum inodorum</i>			1		II
<i>Vicia cracca</i>		1			II
<i>Alnus glutinosa</i>				A	
<i>Atriplex prostrata</i>		A			
<i>Buddleja davidii</i>	A				
<i>Centaurea nigra</i>	A				
<i>Epilobium hirsutum</i>		A			
<i>Epilobium parviflorum</i>					
<i>Eupatorium cannabinum</i>	A	A			
<i>Juncus inflexus</i>				A	
<i>Lycopus europaeus</i>		A			
<i>Melilotus altissimus</i>				A	
<i>Myosotis arvensis</i>	A			A	
<i>Prunus spinosa</i>			A		
<i>Veronica chamaedrys</i>	A				
Total species	17	14	19	16	
Cover (%)	100	100	90	95	
Average sward height (cm)	110	90	80	100	

Grassland and scrub on flood bank (TN1)

The flood bank at the top of the shore supports a mix of rough grass and scrub, with a rough stone surfaced footpath along the top. The flora here was described as a target note rather than sampled using quadrats. The grassland elements are mostly typical of species-poor MG1 *Arrhenatherum elatius* grassland (less diverse than the MG1 at TN3), dominated by False Oat-grass and Cock's-foot, with tall herbs including Nettle, Hemp Agrimony and Broad-leaved Dock. Towards the edge of the footpath the vegetation grades into OV23 *Lolium perenne* - *Dactylis glomerata* grassland and OV21 *Poa annua* - *Plantago major* community in the most heavily trampled parts.

Scrub lines both sides of the path in varying amounts and densities. In its minimal form (mostly in the northern part) it comprises sparse plants of Hawthorn and Bramble amongst the tall grassland. The densest parts are continuous strips of dense Bramble, Blackthorn and Hawthorn with climbing Traveller's Joy and a ground flora of Ivy.

Locally notable species associated with the grassland on the flood bank included Stone Parsley and Black Horehound, which both occur in small patches beside the footpath. The Black Horehound is mostly limited to the northern part of the study area.

Japanese Knotweed is present in a few places beside the inland edge of the footpath. However, it is feasible that some of the Knotweed roots extend underneath the footpath into the grassland of the study area.



*Fragmentary MG1
Arrhenatherum elatius
grassland on top of flood bank.*



Dense Bramble and Blackthorn scrub on flood bank.

Grassland and scrub on flood bank (TN4)

The flood bank at the south-eastern end of the study section appears higher, wider and more recently formed than the rest of the embankment. Most of it is covered by a mix of light Butterfly Bush scrub, with denser areas of Bramble. The more open parts (which were probably more extensive before the scrub closed over) support a variable, flower-rich sward, patchily grazed by Rabbits. It is clearly in a transitional state as the vegetation becomes colonised by scrub, but appears to have elements of MG1 *Arrhenatherum elatius* grassland and open vegetation, but not readily conforming to a published NVC community. Frequent plant species in these open areas included Red Fescue, Yarrow, Teasel, Ragwort, Colt's-foot, Common Knapweed, Bird's-foot Trefoil, Selfheal and Ox-eye Daisy.

Locally notable species observed in this vegetation included scattered plants of Viper's Bugloss and Yellow-wort.



*Fragmentary MG1
Arrhenatherum elatius
grassland and open vegetation
with Butterfly Bush and
Bramble scrub on flood bank.*

The combined list of plant species observed on the flood bank at TN1 and TN4 is as follows:

<i>Acer pseudoplatanus</i>	<i>Hypericum perforatum</i>
<i>Achillea millefolium</i>	<i>Hypochaeris radicata</i>
<i>Agrimonia eupatoria</i>	<i>Juncus inflexus</i>
<i>Agrostis capillaris</i>	<i>Lepidium draba</i>
<i>Agrostis stolonifera</i>	<i>Leucanthemum vulgare</i>
<i>Anagallis arvensis</i>	<i>Lolium perenne</i>
<i>Arctium minus</i>	<i>Lotus corniculatus</i>
<i>Arrhenatherum elatius</i>	<i>Malva moschata</i>
<i>Ballota nigra</i>	<i>Medicago lupulina</i>
<i>Bellis perennis</i>	<i>Melilotus altissimus</i>
<i>Beta vulgaris</i>	<i>Odontites vernus</i>
<i>Blackstonia perfoliata</i>	<i>Oenothera biennis sl.</i>
<i>Brachythecium rutabulum</i>	<i>Pastinaca sativa</i>
<i>Bryum sp.</i>	<i>Persicaria amphibia</i>
<i>Buddleia davidii</i>	<i>Petasites fragrans</i>
<i>Calystegia sepium</i>	<i>Phragmites australis</i>
<i>Carex hirta</i>	<i>Plantago lanceolata</i>
<i>Carex pendula</i>	<i>Plantago major</i>
<i>Centaurea nigra</i>	<i>Poa annua</i>
<i>Cerastium fontanum</i>	<i>Poa trivialis</i>
<i>Chamerion angustifolium</i>	<i>Potentilla anserina</i>
<i>Chenopodium album</i>	<i>Potentilla reptans</i>
<i>Cirsium arvense</i>	<i>Prunella vulgaris</i>
<i>Cirsium vulgare</i>	<i>Prunus spinosa</i>
<i>Clematis vitalba</i>	<i>Pulicaria dysenterica</i>
<i>Convolvulus arvensis</i>	<i>Ranunculus acris</i>
<i>Conyza floribunda</i>	<i>Ranunculus repens</i>
<i>Crataegus monogyna</i>	<i>Rosa canina</i>
<i>Crepis capillaris</i>	<i>Rubus fruticosus</i>
<i>Cynosurus cristatus</i>	<i>Rumex conglomeratus</i>
<i>Dactylis glomerata</i>	<i>Rumex crispus</i>
<i>Daucus carota</i>	<i>Rumex obtusifolius</i>
<i>Didymodon insulanus</i>	<i>Sambucus nigra</i>
<i>Dipsacus fullonum</i>	<i>Senecio erucifolius</i>
<i>Epilobium hirsutum</i>	<i>Senecio jacobaea</i>
<i>Epilobium parviflorum</i>	<i>Sison amomum</i>
<i>Equisetum arvense</i>	<i>Smyrniolum olusatrum</i>
<i>Eupatorium cannabinum</i>	<i>Solanum dulcamara</i>
<i>Fallopia japonica</i>	<i>Sonchus arvensis</i>
<i>Festuca rubra</i>	<i>Sonchus oleraceus</i>
<i>Fragaria vesca</i>	<i>Stachys sylvatica</i>
<i>Fraxinus excelsior</i>	<i>Taraxacum sp.</i>
<i>Galium album</i>	<i>Torilis japonica</i>
<i>Galium verum</i>	<i>Trifolium dubium</i>
<i>Geranium dissectum</i>	<i>Trifolium pratense</i>
<i>Hedera helix</i>	<i>Trifolium repens</i>
<i>Helminthotheca echioides</i>	<i>Tussilago farfara</i>
<i>Heracleum sphondylium</i>	<i>Urtica dioica</i>
<i>Hirschfeldia incana</i>	<i>Verbena officinalis.</i>
<i>Holcus lanatus</i>	<i>Veronica chamaedrys</i>
<i>Homalothecium lutescens</i>	<i>Vicia cracca</i>

4. Evaluation

This section evaluates the nature conservation significance of the plant communities in a geographical context, following the approach set out in 'Guidelines for Ecological Impact Assessment' (CIEEM, 2016). The criteria used to assist in the evaluation are summarised in Table 9.

Table 9: Evaluation of habitats

Level of Value	Habitats
International	Areas designated as Special Areas of Conservation (SAC), Special Protection Areas (SPA) or Ramsar sites in response to European Directives and International Conventions.
National	Areas designated as Sites of Special Scientific Interest (SSSI), National Nature Reserve (NNR), or equivalent for key areas, habitats and plant communities.
Regional	Areas of habitat of suitable size and quality to be considered for notification as SSSI (based on Guidelines for the Selection of Biological SSSIs, JNCC 1998). Extensive areas of Environment (Wales) Act (2016) Section 7 habitats, listed as 'habitats of principal importance for the purpose of maintaining and enhancing biodiversity in relation to Wales.
County	Areas meeting Wildlife Sites Guidelines selection criteria; areas of Section 7 habitats; areas of Ancient woodland.
District/Local value	Areas of LBAP habitat. Important hedgerows classified under The Hedgerow Regulations 1997. Any non-designated habitat assemblage of moderate biodiversity value.

In this case virtually the whole of the study area lies within the River Usk SAC/ Lower Usk SSSI, and it is therefore considered part of an internationally important site. Interestingly, a narrow strip of saltmarsh habitat at the south-eastern end of the study area (where the saltmarsh vegetation extends along a small creek towards) actually lies outside the official SAC and SSSI boundary. In practice this minor difference probably makes no difference to the proposed flood bank project, as it is unlikely to be affected by the works.



Dittander in disturbed ground beside conveyor belt.

None of the plant species recorded during the survey is included in the Environment (Wales) Act 2016 Section 7 lists of species of 'principal importance for the purpose of maintaining and enhancing biodiversity in relation to Wales'. However, several were found that are listed as being locally notable in the Wildlife Sites Guidelines (Wales Biodiversity Partnership, 2008). Under these guidelines a site is considered significant in a county context if it supports one or more Primary Species or five or more Contributory Species. In this case the notable species recorded are summarised in Table 10, showing that the significance criteria are met in this case.

Table 10: Summary of locally notable plant species

	Species	Observations
Primary species	Dittander (<i>Lepidium latifolium</i>)	Frequent near top of shore, especially in disturbed areas.
Contributory species	Marsh Mallow (<i>Althaea officinalis</i>)	Two plants noted at top edge of saltmarsh (Quadrat 4)
	Black Horehound (<i>Ballota nigra</i>)	Occasional in rough grassland on top of flood bank in north of study area.
	Long-bracted Sedge (<i>Carex extensa</i>)	One tussock in previously disturbed ground beside tidal pool near top of shore.
	Viper's Bugloss (<i>Echium vulgare</i>)	Several plants in rabbit-grazed vegetation in open patches amongst scrub at TN4.
	Narrow-leaved Everlasting Pea (<i>Lathyrus sylvestris</i>)	One plant in disturbed ground at TN2.
	Bee Orchid (<i>Ophrys apifera</i>)	One plant noted in rough grassland on previously disturbed ground at TN3.
	Stone Parsley (<i>Sison amomum</i>)	Occasional throughout the length of the flood bank, generally as small patches.



Long-bracted Sedge beside tidal pool.

In addition to the plants noted for their rarity, Japanese Knotweed is notable because of its listing on Schedule 9 of the Wildlife and Countryside Act as a non-native invasive species. The presence of this species should also be taken into account during the proposed flood-bank works as it would be unlawful to cause it to spread in the wild.



A dense patch of Japanese Knotweed beside the flood-bank footpath.

5. Recommendations

The current flood defence proposals would involve increasing the height of the flood bank. Works on the embankment are unlikely to have an impact on the saltmarsh plant communities along the seaward edge of the study area, and the greatest impact would be on the vegetation on and near to the existing flood bank. It would be appropriate to target mitigation measures to the key features of this area. The proposed M4 Corridor around Newport might also have impacts on part of the study area, which would potentially have a greater impact on the seaward plant communities and reduce the area of saltmarsh vegetation. Any implementation of mitigation measures would need to be agreed by Natural Resources Wales due to the site's SAC and SSSI designations.

It is recommended that the material to be used to form the new embankment should be as similar as possible to the soils that have been used previously, to give the best chance of recolonisation by a similar flora.

In some cases it may be appropriate to retain certain key species if they lie at the margins of the proposed works area. Protecting them by using temporary fencing might be possible in some cases. If uncommon plants cannot be retained *in situ*, there may be potential to dig them up carefully and transplant them to a safer part of the study area, provided that there is suitable habitat in that location.

A key recommendation for conserving the flora would normally be to minimise the area of saltmarsh habitat that is affected by engineering works, avoiding the SAC as far as possible. However, in this case it may also be appropriate to consider localised mitigation works within the area of saltmarsh to compensate for losses due to the proposed works. The tidal pools that were created near the top of the shore as a result of access by construction machinery five years ago have already developed an interesting saltmarsh flora that is more diverse than the SM24 Sea Couch vegetation (which is mostly dominated by a single-species). Consideration could therefore be given to extending these or creating additional

tidal pools within species-poor parts of the saltmarsh, increase the overall vegetation diversity.

It is also recommended that the saltmarsh should be subject to periodic litter collections. There are many accumulations of tidal litter, including a substantial proportion of plastic waste, and removing these would be beneficial for plants and other wildlife.

Eradication of the Japanese Knotweed is strongly recommended. This should preferably be undertaken well in advance of the proposed engineering works, to remove the potential for spreading it. Knotweed removal may require several years of herbicide treatment and it would be advisable to contact a Knotweed specialist to carry out the work.

At present the flood bank appears to have little or no vegetation management except occasionally clearing the line of the footpath, and this results in a gradual loss of plant diversity as the grassland habitats eventually become covered by low-diversity scrub. In the long term it would be advantageous to make provision for periodic management to maintain a variety of grassland vegetation types on the new embankment and limit scrub encroachment.

6. References

CIEEM (2016). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal. Second Edition, January 2016. Chartered Institute for Ecology and Environmental Management.

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

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Wales Biodiversity Partnership (2008). Guidelines for the Selection of Wildlife Sites in Wales.

Appendix 1. Plant species list

The following species were all identified during the vegetation survey. However, due to the size of the site and nature of the sampling this should not be considered a comprehensive list of every plant species within the study area.

Species	Common name
VASCULAR PLANTS	
<i>Acer pseudoplatanus</i>	Sycamore
<i>Achillea millefolium</i>	Yarrow
<i>Agrimonia eupatoria</i>	Agrimony
<i>Agrostis capillaris</i>	Common Bent
<i>Agrostis stolonifera</i>	Creeping Bent
<i>Alnus glutinosa</i>	Alder
<i>Althaea officinalis</i>	Marsh Mallow
<i>Anagallis arvensis</i>	Scarlet Pimpernel
<i>Arctium minus</i>	Lesser Burdock
<i>Arenaria serpyllifolia</i>	Thyme-Leaved Sandwort
<i>Arrhenatherum elatius</i>	False Oat-grass
<i>Artemisia vulgaris</i>	Mugwort
<i>Aster tripolium</i>	Sea Aster
<i>Atriplex prostrata</i>	Spear-leaved Orache
<i>Ballota nigra</i>	Black Horehound
<i>Bellis perennis</i>	Daisy
<i>Beta vulgaris</i>	Sea Beet
<i>Blackstonia perfoliata</i>	Yellow-wort
<i>Bolboschoenus maritimus</i>	Sea Club-rush
<i>Buddleia davidii</i>	Buddleia
<i>Calystegia sepium</i>	Hedge Bindweed
<i>Carex arenaria</i>	Sand Sedge
<i>Carex extensa</i>	Long-bracted Sedge
<i>Carex hirta</i>	Hairy Sedge
<i>Carex otrubae</i>	False Fox-sedge
<i>Carex pendula</i>	Pendulous Sedge
<i>Centaurea nigra</i>	Common Knapweed
<i>Centaureum erythraea</i>	Common Centaury
<i>Cerastium fontanum</i>	Common Mouse-ear
<i>Chamerion angustifolium</i>	Rose-Bay Willowherb
<i>Chenopodium album</i>	Fat Hen
<i>Chenopodium rubrum</i>	Red Goosefoot
<i>Cirsium arvense</i>	Creeping Thistle
<i>Cirsium vulgare</i>	Spear Thistle
<i>Clematis vitalba</i>	Traveller's Joy
<i>Cochlearia anglica</i>	English Scurvy-grass
<i>Convolvulus arvensis</i>	Field Bindweed
<i>Conyza floribunda</i>	Bilbao Fleabane
<i>Crataegus monogyna</i>	Hawthorn
<i>Crepis capillaris</i>	Smooth Hawkbit
<i>Cynosurus cristatus</i>	Crested Dog's-tail
<i>Dactylis glomerata</i>	Cock's-foot Grass
<i>Daucus carota</i>	Wild Carrot
<i>Dipsacus fullonum</i>	Teasel

Species	Common name
<i>Elytrigia atherica</i>	Sea Couch
<i>Epilobium hirsutum</i>	Greater Willowherb
<i>Epilobium parviflorum</i>	Hoary Willowherb
<i>Equisetum arvense</i>	Field Horsetail
<i>Eupatorium cannabinum</i>	Hemp Agrimony
<i>Fallopia japonica</i>	Japanese Knotweed
<i>Festuca rubra</i>	Red Fescue
<i>Fragaria vesca</i>	Wild Strawberry
<i>Fraxinus excelsior</i>	Ash
<i>Galeopsis sp.</i>	Hemp Nettle
<i>Galium album</i>	Hedge Bedstraw
<i>Galium verum</i>	Lady's Bedstraw
<i>Geranium dissectum</i>	Cut-leaved Crane's-bill
<i>Glaux maritima</i>	Sea Milkwort
<i>Hedera helix</i>	Ivy
<i>Helminthotheca echioides</i>	Bristly Ox-tongue
<i>Heracleum sphondylium</i>	Hogweed
<i>Hirschfeldia incana</i>	Hoary Mustard
<i>Holcus lanatus</i>	Yorkshire Fog
<i>Hypericum perforatum</i>	Perforate St. John's-wort
<i>Hypochaeris radicata</i>	Common Cat's-Ear
<i>Juncus gerardii</i>	Saltmarsh Rush
<i>Juncus inflexus</i>	Hard Rush
<i>Lathyrus sylvestris</i>	Narrow-leaved Everlasting Pea
<i>Lepidium draba</i>	Hoary Cress
<i>Lepidium latifolium</i>	Dittander
<i>Leucanthemum vulgare</i>	Ox-eye Daisy
<i>Leycesteria formosa</i>	Himalayan Honeysuckle
<i>Lolium perenne</i>	Perennial Rye-grass
<i>Lotus corniculatus</i>	Common Bird's-foot Trefoil
<i>Lycopus europaeus</i>	Gypsywort
<i>Malva moschata</i>	Musk Mallow
<i>Medicago lupulina</i>	Black Medick
<i>Melilotus altissimus</i>	Tall Melilot
<i>Myosotis arvensis</i>	Field Forget-me-not
<i>Odontites vernus</i>	Red Bartsia
<i>Oenanthe crocata</i>	Hemlock Water-dropwort
<i>Oenothera biennis sl.</i>	Common Evening Primrose
<i>Ononis repens</i>	Restharrow
<i>Ophrys apifera</i>	Bee Orchid
<i>Pastinaca sativa</i>	Wild Parsnip
<i>Persicaria amphibia</i>	Amphibious Bistort
<i>Petasites fragrans</i>	Winter Heliotrope
<i>Phalaris canariensis</i>	Canary-grass
<i>Phragmites australis</i>	Common Reed
<i>Plantago coronopus</i>	Buck's-horn Plantain
<i>Plantago lanceolata</i>	Ribwort Plantain
<i>Plantago major</i>	Greater Plantain
<i>Plantago maritima</i>	Sea Plantain
<i>Poa annua</i>	Annual Meadow-grass
<i>Poa trivialis</i>	Rough Meadow-grass

Species	Common name
<i>Polygonum aviculare</i>	Knotgrass
<i>Potentilla anserina</i>	Silverweed
<i>Potentilla reptans</i>	Creeping Cinquefoil
<i>Prunella vulgaris</i>	Self-Heal
<i>Prunus spinosa</i>	Blackthorn
<i>Puccinellia maritima</i>	Common Saltmarsh-grass
<i>Pulicaria dysenterica</i>	Fleabane
<i>Ranunculus acris</i>	Meadow Buttercup
<i>Ranunculus repens</i>	Creeping Buttercup
<i>Ranunculus sceleratus</i>	Celery-leaved Buttercup
<i>Rosa canina</i>	Dog Rose
<i>Rubus fruticosus</i>	Bramble
<i>Rumex conglomeratus</i>	Clustered Dock
<i>Rumex crispus</i>	Curled Dock
<i>Rumex obtusifolius</i>	Broad-Leaved Dock
<i>Sambucus nigra</i>	Elder
<i>Sedum acre</i>	Biting Stonecrop
<i>Senecio erucifolius</i>	Hoary Ragwort
<i>Senecio jacobaea</i>	Ragwort
<i>Senecio vulgaris</i>	Groundsel
<i>Sison amomum</i>	Stone Parsley
<i>Smyrniolum olusatrum</i>	Alexanders
<i>Solanum dulcamara</i>	Bittersweet
<i>Sonchus arvensis</i>	Perennial Sow-thistle
<i>Sonchus asper</i>	Prickly Sow-thistle
<i>Sonchus oleraceus</i>	Smooth Sow-thistle
<i>Spartina anglica</i>	Common Cord-grass
<i>Spergularia marina</i>	Lesser Sea-spurrey
<i>Spergularia media</i>	Greater Sea-spurrey
<i>Stachys sylvatica</i>	Hedge Woundwort
<i>Suaeda maritima</i>	Annual Sea-blite
<i>Taraxacum</i> sp.	Dandelion
<i>Torilis japonica</i>	Upright Hedge-parsley
<i>Trifolium dubium</i>	Lesser Trefoil
<i>Trifolium pratense</i>	Red Clover
<i>Trifolium repens</i>	White Clover
<i>Triglochin maritimum</i>	Sea Arrowgrass
<i>Tripleurospermum inodorum</i>	Scentless Mayweed
<i>Tripleurospermum maritimum</i>	Sea Mayweed
<i>Tussilago farfara</i>	Colt's Foot
<i>Urtica dioica</i>	Nettle
<i>Verbena officinalis</i> .	Vervain
<i>Veronica chamaedrys</i>	Germander Speedwell
<i>Veronica persica</i>	Common Field-speedwell
<i>Vicia cracca</i>	Tufted Vetch
BRYOPHYTES	
<i>Brachythecium rutabulum</i>	Rough-stalked Feather-moss
<i>Bryum</i> sp.	Thread-moss
<i>Didymodon insulanus</i>	Cylindric Beard-moss
<i>Homalothecium lutescens</i>	Yellow Feather-moss

Species	Common name
<i>Schistidium crassipilum</i>	Thickpoint Grimmia
<i>Syntrichia ruralis var. ruraliformis</i>	Sandhill Screw-moss
<i>Thuidium tamariscinum</i>	Common Tamarisk-moss
LICHENS	
<i>Lecidella elaeochroma</i>	Lichen
<i>Physcia tenella</i>	Lichen
<i>Xanthoria parietina</i>	Lichen

Appendix 2. Incidental fauna observations

Species	Common name
DRAGONFLIES	
<i>Anax imperator</i>	Emperor Dragonfly
BUTTERFLIES & MOTHS	
<i>Autographa gamma</i>	Silver Y Moth
<i>Polyommatus icarus</i>	Common Blue Butterfly
<i>Pieris napi</i>	Green-veined White Butterfly
<i>Vanessa atalanta</i>	Red Admiral Butterfly
<i>Pararge aegeria</i>	Speckled Wood Butterfly
BEES	
<i>Bombus cf humilis</i>	Brown-banded Carder Bee
BIRDS	
<i>Anas platyrhynchos</i>	Mallard
<i>Carduelis carduelis</i>	Goldfinch
<i>Columba palumbus</i>	Wood Pigeon
<i>Corvus corone</i>	Carrion Crow
<i>Erithacus rubecula</i>	Robin
<i>Haematopus ostralegus</i>	Oystercatcher
<i>Hirundo rustica</i>	Swallow
<i>Larus argentatus</i>	Herring Gull
<i>Larus fuscus</i>	Lesser Black-backed Gull
<i>Larus ridibundus</i>	Black-headed Gull
<i>Pica pica</i>	Magpie
<i>Prunella modularis</i>	Dunnock
<i>Riparia riparia</i>	Sand Martin
<i>Tringa totanus</i>	Redshank
MAMMALS	
<i>Oryctolagus cuniculus</i>	Rabbit (droppings)