Natural Resources Wales

Stephenson Street Flood Defence Scheme

Preliminary Ecological Appraisal - Stephenson Street Embankment

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1 Introduction

1.1 Background

Ove Arup and Partners Limited (Arup) has been commissioned by Natural Resources Wales (NRW) to undertake an ecological appraisal in relation to proposed improvement works to the Stephenson Street flood defence embankment, to reduce flood risk from the River Usk on the Spytty area of Newport.

An existing 1,350m long flood defence embankment is located on the left (eastern) bank of the River Usk from Stephenson Street at the north to Corporation Road (Bird Port) in the south. This section of flood defence is commonly referred to as Stephenson Street Embankment.

Stephenson Street Embankment (hereafter referred to as the Site) provides tidal flood risk protection to much of the Spytty area of Newport. This includes significant industry, leisure and residential properties. In the embankment's current condition, it would be classified as a failing asset due to subsidence and structural failures. Modelling predicts that defence enhancements are required both along the Stephenson Street Embankment parallel to the River Usk, and to the south at Corporation Road (within Bird Port).

The preferred solution comprises:

1. Stephenson Street Embankment enhancement; two different designs proposed. An earth bund next to the Coronation Park (250m section) and a sheet piled wall along the remainder of the length (950m section) until Bird Port.
2. Corporation Road (Bird Port) flood defences, comprising road raising and flood walls.

This Ecological Appraisal details ecological baseline conditions, identifies ecological constraints, informs detailed design, assesses ecological impacts and provides recommendations for avoidance and mitigation measures, in addition to further survey requirements where appropriate.

1.2 Proposed Works

The proposed improvement works to Stephenson Street flood defence embankment aim to manage flood risk in accordance with the Severn Estuary Flood Risk Management Strategy (i.e. hold the line with a standard of protection of 1:200 year tidal event with sea level rise). The preferred solution is as follows:

- Coronation Park (250m section): raise crest level of existing standard NRW earth bund by between 0.5m and 1.0m above the existing level (to 9.03m Above Ordnance Datum (AOD)) and the slopes slackened to 1V:3H taking up 8m of land from Coronation Park. These works will primarily comprise of filling above the existing ground level, with only shallow

excavation required to remove the existing topsoil within the footprint of the proposed bund.

- Stephenson Embankment (950m section): construction of a sheet pile wall through the crest of the existing embankment. The above ground upstand is typically 0.5m in height, but locally up to circa 1.0 in height. The required pile length is circa 7m, except in areas where the ground level on the dry side of the wall is lower, such as where ponds and drainage ditches are present, where a longer pile is required.
- South Section (Bird Port, Corporation Road): combination of raising flood walls and road raising.

1.3 Study Area

A public footpath runs through the centre of the Site, along the existing flood defence embankment. To the west of this is saltmarsh and intertidal mud of the River Usk. To the east is a mosaic of habitats including: amenity grassland to the north within Coronation Park, and towards the south: a mixture of scrub, swamp and standing water amongst areas of hardstanding, spoil and a manmade conveyor which extends into the saltmarsh and intertidal areas.

The Site, northern extent National Grid Reference (NGR) ST 31919 86152, southern extent NGR ST 32873 85428 is shown on Figure 1.

1.4 Objectives

The objective of the work included the following;

- To establish baseline ecological conditions on Site and within the immediate vicinity, including its potential to support important habitats and notable/protected species;
- To identify key ecological constraints to the proposed works;
- To inform project design to allow significant ecological effects to be avoided or minimised wherever possible;
- To recommend further ecological surveys required to inform an updated ecological assessment as appropriate.

1.5 Legislative Context

A framework of international (European), national and local legislation and planning policy guidance exists to protect and conserve wildlife and habitats. The following core legislation exists to protect habitats and species of nature conservation importance:

i. The Conservation of Habitats and Species Regulations 2017 (the Habitat Regulations) which transposes Council Directive 92/43/EEC on the

Conservation of Natural Habitats and of Wild Fauna and Flora (the Habitats Directive) into UK law;

ii. The Birds Directive (Council Directive 2009/147/EC on the conservation of wild birds) (the Wild Birds Directive);

iii. Wildlife and Countryside Act 1981 (as amended) (WCA);

iv. Environment (Wales) Act 2016 including Section 7 biodiversity lists;

v. The Countryside and Rights of Way Act 2000;

vi. The Hedgerow Regulations 1997; and

vii. Protection of Badgers Act 1992.

These pieces of legislation include a number of offences relating to protected species and requirements for licences to allow construction works to proceed. In addition, the Habitats Regulations set out the requirement for the consideration of the potential effects of a project on European Sites.

Actions which are prohibited by legislation can be made lawful on the approval and granting of a protected species licence from NRW, subject to conditions.

Full details of the legislation are provided in Appendix A.

2 Methods

2.1 Desk study

A desk study was carried out to identify statutory internationally designated Sites (European Sites) within 5km and nationally designated Sites within 2km of the Site centre point. Online searches were carried out using the Multi Agency Geographic Information for the Countryside (MAGIC)[1], Natural Resources Wales website[2] and the Joint Nature Conservation Committee (JNCC) website[3]. Statutory and Non-Statutory sites are shown in Figure 2.

A biodiversity records request of data was provided by South East Wales Biodiversity Records Centre (SEWBReC)[4] on 15 March 2018.

The records included protected and priority species[5] up to 2km from the proposed works, and included details of local designations such as Sites of Importance for Nature Conservation (SINCs) within 2km.

2.2 Field Survey

The method for the initial Extended Phase 1 Survey and subsequent Phase 2 species and botanical surveys are summarised below:

2.2.1 Extended Phase 1 Habitat Survey

The aim of the Extended Phase 1 Habitat Survey was to identify the habitats present within the Site and up to 50m from the Site where access allowed, that may be affected by the proposed works. The survey was undertaken broadly following the standard JNCC Phase 1 Habitat Survey methodology[6] on 13th March 2018. Extended Phase 1 Habitat survey is a standard technique for rapidly obtaining baseline ecological information over a large area of land. It is primarily a mapping technique and uses a standard set of habitat definitions for classifying areas of land on the basis of the vegetation present.

The survey also provided an assessment of the potential for habitats present to support legally protected species. Relevant species included all those protected by European or UK law, and notable species including those identified as being of principal importance in Wales, in response to Section 7 of the Environment (Wales) Act 2016 (Appendix A), as follows:

[1] http://magic.defra.gov.uk/ Accessed online 20/05/2018.
[2] https://naturalresources.wales/conservation-biodiversity-and-wildlife/find-protected-areas-of-land-and-seas/designated-Sites-search/?lang=en Accessed online 20/05/2018
[3] http://jncc.defra.gov.uk Accessed online 20/05/2018
[4] http://www.sewbrec.org.uk/home.page
[5] EU and UK legally protected species under the Conservation of Habitats and Species Regulations 2010 (as amended) and Wildlife and Countryside Act 1981 (as amended); and species present on the Species of Principal Importance in Wales list in response to Section 7 of the Environment (Wales) Act 2016 (known as Section 7 species).
[6] Joint Nature Conservation Committee, 2016. Handbook for Phase 1 habitat survey – a technique for environmental audit. http://jncc.defra.gov.uk/page-2468

- Any buildings or trees within the boundary were appraised (from the ground only) for their suitability to support breeding, resting and hibernating bats using survey methods based on those outlined in the Bat Conservation Trust's Bat Surveys: Good Practice Guidelines[7].
- Assessing the potential of terrestrial and aquatic habitats to support amphibians, both protected species and species of conservation concern. A Habitat Suitability Index (HSI)[8] was assigned to all permanent waterbodies to assess their potential to support great crested newt (GCN) (*Triturus cristatus*).
- Searching for signs of badger (*Meles meles*) activity including setts, tracks, foraging holes and latrines within and up to 30m from the Site where possible. Any setts recorded were classified according to published criteria[9].
- Assessing the suitability of habitats for nesting birds (including any old nests);
- Assessing the suitability of habitats for common species of reptiles; adder, (*Vipera beres)*, grass snake (*Natrix natrix),* slow worm (A*nguis fragilis)* and common lizard (*Zootoca vivipara*) based on guidance outlined in the JNCC published Herpetofauna Workers' Manual.
- Assessing the suitability of watercourses for water vole *(Arvicola amphibius*)[10], otter *(Lutra lutra*)[11] and white-clawed crayfish *(Austropotamobius pallipes)*[12] based on published guidance for each species.
- Assessing the suitability of habitats for dormice (*Muscardinus avellalanrius*)[13].
- Assessing the suitability of habitats for notable invertebrates.
- Evidence of the presence of invasive plants listed on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) and subject to strict legal control, such as Japanese knotweed (*Fallopia japonica*), Himalayan balsam (*Impatiens glandulifera*) and giant hogweed (*Heracleum mantegazzianum*).

All accessible areas of the Site were walked and the relevant habitat types classified according to their vegetation types. Habitat areas greater than 0.1ha were mapped on the Phase 1 Habitat Map (Figure 3) and Target Notes (TNs) were used to highlight any features or habitats of interest and that provide suitable habitat for protected species.

[7] Collins, J. (2016). Bat Surveys: Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn.). The Bat Conservation Trust, London.
[8] Odiham et al (2000) in ARG UK Advice Note 5: Great Crested Newt Habitat Suitability Index
[9] Harris, S., Cresswell, P. and Jefferies, D., 1989. Surveying Badgers. Mammal Society.
[10] Strachan, R. and Moorhouse, T., 2006. Water Vole Conservation Handbook, 2nd Edition.
[11] Chanin, P., 2003. Monitoring the Otter, Lutra lutra. Conserving Natura 2000 Rivers Monitoring Series No. 10., English Nature, Peterborough.
[12]Peay, Stephanie. (2002), Guidance on Habitat for White-clawed Crayfish and its restoration. Environment Agency.
[13] Bright. Paul, Morris. P, Mitchell Jones, T. (2006 updated) The Dormouse Conservation Handbook 2nd ed. English Nature.

2.2.2 Habitat Suitability Index (HSI) Survey

A search was made for waterbodies with potential to support GCN within 250 m of the Site based on Ordnance Survey mapping and during the Extended Phase 1 Survey in March 2018. These were assessed for breeding habitat suitability using the standard HSI[14] methodology by Arup ecologists. The HSI is a numerical index which ranges from 0 and 1. It is calculated using ten key habitat criteria and is based on the assumption that the habitat quality determines great crested newt presence/absence. Using this standard approach, waterbodies with high scores are more likely to support breeding GCN than those with a lower score (See Table 1 below). However, this system is not sufficiently precise to conclude that any particular waterbody with a high score will support GCN or that any waterbody with a low score will not. The waterbodies and drains subject to HSI are shown on the Phase 1 Map (Figure 3).

Table 1 – Habitat Suitability Index

HSI	Pond Suitability	Predicted Occupancy
<0.5	Poor	0.03
0.5-0.59	Below Average	0.2
0.6-0.69	Average	0.55
0.7-0.79	Good	0.79
>0.8	Excellent	0.93

Waterbodies with scores over 0.6 are generally considered for further presence/absence surveys.

2.2.3 Environmental DNA (eDNA) sampling

Environmental DNA (eDNA) surveys were carried out by two Arup ecologists, Claire Pooley (NRW Licence no. 78081:OTH:SA:2018) and Debbie Brown (NRW Licence no. 75436:OTH:SA:2017), on four waterbodies and two associated drains in accordance with the guidelines[15], as shown on Figure 3, and optimum

[14] Amphibian and Reptile Groups of the UK (2010) (ARG UK Advice Note 5, Great crested newt Habitat Suitability Index.
[15] Biggs J, Ewald N, Valentini A, Gaboriaud C, Griffiths RA, Foster J, Wilkinson J, Arnett A, Williams P and Dunn F 2014. Analytical and methodological development for improved surveillance of the Great Crested Newt. Appendix 5. Technical advice note for field and laboratory sampling of great crested newt (Triturus cristatus) environmental DNA. Freshwater Habitats Trust, Oxford.

timeframe (mid-April – late June) and sent to FERA[16] for analysis. Samples were taken from waterbodies 1, 2, 3 and two drains on the 18th April 2018 and from waterbody 4 on 10th May 2018.

2.2.4 Reptile Survey

Following the habitat assessment for reptiles as part of the Extended Phase 1 Habitat Survey, presence absence surveys were undertaken in accordance with accepted reptile survey guidelines[17]. Sixty-two artificial refugia made from roofing felt of approximately 50 cm x 50 cm were placed in areas of suitable habitat along the embankment Site on the 17th April 2018. The extent of the reptile survey was from the northwest end of the Site near coronation Park - approximate grid reference ST31928610 to the drain adjoining waterbody 2 - approximate grid reference ST32298567. The reptile mats were checked seven times between the 10th of May and the 19th of July in suitable weather conditions (see Appendix C1).

2.2.5 Riparian Mammal Survey

A riparian mammal survey specifically for otter and water vole was undertaken where access allowed during the Extended Phase 1 Survey on 13th March 2018. However due to thick vegetation access was limited. Two infra-red cameras were set up in suitable habitat at the southern end of Waterbody 1, approximate grid reference ST32068585 and ST32058787 as shown on Figure 3, during a visit to supervise some vegetation clearance across sections of drainage ditches on 27th March and left on Site to record otter or water vole activity. Memory cards were checked and replaced on the 18th April and 15th May and the cameras collected on the 19th July.

During the above reptile surveys between the 10th of May and the 19th of July, checks were also made along accessible waterbody edges including the banks of the river for otter and water vole.

2.2.6 Phase 2 Botanical Survey

A National Vegetation Classification Survey (NVC) was undertaken by Dr Peter Sturgess of Sturgess Ecology on the 15th August 2018, an optimal time for botanical survey, of habitats within the River Usk SSSI and SAC boundary. Survey methodology, weather conditions etc. are detailed within a separate report[18] provided in Annexe A.

[16] FERA webSite accessed 17/08/18: https://www.fera.co.uk/environmental-science/environmental-dna
[17] Froglife Advice Sheet 10 (1999) Reptile survey, an Introduction to planning, conducting and interpreting surveys for snake and lizard conservation.
[18] P. Sturgess (2018) Stephenson Street Embankment, Newport: Vegetation Survey. Ove Arup and Partners.

2.3 Limitations

During the Extended Phase 1 Habitat survey some areas of the survey areas were inaccessible due to health and safety concerns, dense vegetation and security fencing. In these areas the detectability of some species was limited; e.g. otters, water voles and badgers. Further survey was enabled during ecological watching brief for vegetation clearance required for the topographical surveys. This provided greater visibility for species such as badgers, water voles and otters. Due to the ecological briefs it is considered that sufficient survey effort was undertaken in order to assess the presence or likely absence of species, and to fulfil this report's objectives; at least for otter and badger. Water vole are discussed further below.

The initial riparian mammal survey, undertaken in March, whilst suitable to undertake otter surveys, was at a sub-optimal time of year for water vole; guidance[19] requires two visits, with the first being between mid-April and June, and the second between July and September. It is considered that conditions in March were sufficient to undertake an initial habitat appraisal for water vole. Additional visits to the Site in April and May to deploy/check cameras, in addition to the ecological briefs and checks undertaken during reptile surveys, which included searches for signs of water vole, were considered sufficient to determine likely presence/absence.

The initial habitat survey was conducted in March, just outside of the optimal period for botanical surveys (April to October) however the survey recorded sufficient floral species to be able to provide an indicative assessment of the habitats on Site, as required for an Extended Phase 1 Habitat survey. Furthermore, the NVC surveys carried out later in August 2018, provided further botanical detail on habitats within the Site. Specific limitations for these NVC surveys are detailed in the report (Annexe A).

It should be stressed that the findings presented in this study represent those at the time of survey and reporting, and data collected from available sources. Ecological surveys are limited by factors which affect the presence of species, such as temporal weather conditions, migration patterns and behaviour.

The weather is not considered to be a limitation, as all surveys were undertaken during optimal weather conditions. Every effort has been made to ensure that the findings of the study present as accurate an interpretation as possible of the species and habitats within the study area.

[19] M. Dean et al (2016) The water vole mitigation handbook: The mammal society mitigation society. The mammal society, London.

2.4 Assessment Methodology

2.4.1 Nature conservation value

The Chartered Institute of Ecology and Environmental Management (CIEEM) Guidelines for Ecological Impact Assessment in the UK [20] form the basis of impact assessment undertaken. The guidelines recommend that the nature conservation value or potential value of an ecological feature is determined within the following geographic context:

- International;
- National i.e. Wales;
- Regional i.e. South Wales;
- County (Newport);
- Local (i.e. within circa 5km);
- Less than Local (i.e. within the Site);
- Negligible (i.e. hard standing).

2.4.2 Impact Assessment

In accordance with CIEEM guidelines[17] when describing impacts, reference is made to the following:

Magnitude – i.e. the size of an impact in quantitative terms where possible;

Extent – i.e. the area over which an impact occurs;

Duration – i.e. the time for which an impact is expected to last;

Reversibility – i.e. a permanent impact is one that is irreversible within a reasonable timescale or for which there is no chance of action being taken to reverse it. A temporary impact is one from which spontaneous recovery is possible;

Timing and frequency – i.e. whether impacts occur during critical life stages or seasons and how often impacts occur;

Direct or indirect – i.e. direct ecological impacts are changes that are directly attributable to a defined action, e.g. the physical loss of habitat occupied but a species during the construction process. Indirect ecological impacts are attributable to an action, but which affect ecological resource through impacts on an intermediary ecosystem, process or receptor.

[20] CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial Freshwater and Coastal, 2nd Edition. Chartered of ecology and Environmental Management, Winchester.

In accordance with the CIEEM guidelines, a significant impact, in ecological terms, is defined as 'an impact (negative or positive) on the integrity[21] of a defined Site or ecosystem and/or the conservation status[22]

[21] Integrity is the coherence of ecological structure and function, across a Sites whole area that enables it to sustain a habitat, complex of habitats and/ or the levels of populations of species.
[22] Conservation status for habitats is determined by the sum of the influences acting on the habitat and its typical species that may affect is long-term natural distribution, structure, functions as well as the long-term survival of its typical species within the territory.

3 Results

3.1 Desk Study

3.1.1 Statutory Sites

The search using MAGIC highlighted four European Sites and five national statutory designated Sites within 5km and 2km of the Site boundary respectively. All designated Sites and their proximity to the Site are listed in Table 2 below. Figure 2 shows the locations of the designated Sites and further details of each designation citation is provided in Appendix B

Table 2: Statutory designated Sites within 5km and 2km of the Site boundary, for International and national Sites, respectively.

Site Name	Approximate Distance from the Site
Internationally Designated Sites	
River Usk Special Area of Conservation (SAC)	Within the Site
Severn Estuary Ramsar Site	1.5km south (hydrologically connected via the River Usk)
Severn Estuary SAC	1.5km south (hydrologically connected via the River Usk)
Severn Estuary Special Protection Area (SPA)	1.5km south (hydrologically connected via the River Usk)
Nationally Designated Sites	
River Usk SSSI	Within the Site
Newport Wetlands (National Nature Reserve (NNR)	1.5 km south (hydrologically connected via the River Usk)
Gwent Levels – St. Brides SSSI	1.5 km west (hydrologically connected via the River Usk)
Gwent Levels- Nash and Goldcliff SSSI	1.5 km east (hydrologically connected via the River Usk/Severn Estuary)

3.1.2 Non-Statutory Sites

There are seven non-statutory designated sites within 2km of the Site. Further details of each designation citation are provided in Appendix B

Site Name	Approximate Distance from the Site
Marshall's SINC	Forms the embankment that is the Site
Solutia	450m- east of the Site
Alpha Steel	520m east of the Site
Money Island	1.2km north east of the Site
Julian's Gout Land	1.3km south east of the site
Gwent Wetland Reserve	1.6km south of the Site
Afon Ebbw River	1.7km west of the Site. It is on the other side of the River Usk but is hydrologically connected.

Marshall's Site of Importance for Nature Conservation (SINC) comprises the entire flood embankment and land to the east. It is notified for its mosaic of habitats including scrub and tall ruderal, post-industrial land, neutral grassland and wetland along the banks of the Usk.

The remaining SINCS within 2km are over 450 m away from the proposed works and it is therefore negative effects as a result of the proposed works are considered to be unlikely.

3.1.3 Protected and Notable Species

NRW provided data via SEWBReC on protected and notable species within 2km of the Site boundary. Reptiles, amphibians and mammal records are detailed in Table 3.

Table 3. Summary of protected reptile, amphibian, mammal records within 2km of the Site boundary from the last ten years. Distances are approximate.

Species / Group	Status [23]	Summary of Records	Year of nearest record[24]
Amphibians and Reptiles			
Great crested newt *(Triturus cristatus)*	EPS, WCA	Eight records with the closest 976m in south east Newport Docks.	Most recent record in 2015.
Slow worm *(Anguis fragilis)*	WCA	One record 1.8km north west in Maes Glas Landfill Site.	2015
Common lizard (*Zootoca vivpara)*	WCA	Two records with the closest 1.1km west in Newport Docks.	Most recent record 2011.
Bats			
Unidentified bat (*Chiroptera)*	EPS, WCA	Two records with the closest 1.5km south in Alphasteel Site.	2008
Noctule bat (*Nyctalus noctula)*	EPS, WCA	Two records with the closest 588m north west in Newport Docks.	2012
Brown long-eared bat *(Plecotus auritus)*	EPS, WCA	One record of a roost 1.3km south west in Hains Court	2011
Common pipistrelle *(Pipistrellus pipistrellus)*	EPS, WCA	Six records with the closest 588m west in Newport docks.	2012
Daubenton's bat *(Myotis daubentonii)*	EPS, WCA	One record 2.4km south in Newport Wetlands: Uskmouth.	2009.
Nathusius' pipistrelle *(Pipistrellus nathusii)*	EPS, WCA	Two records with the closest of a roost 2.9km in an unknown location.	2015
Natterer's bat *(Myotis nattereri)*	EPS, WCA	One record 2km east	2011
Mammals			
Otter (*Lutra lutra)*	EPS, WCA	On record 1.2km north at SDR Bridge: right bank shoreline. There is potential for otter within the Site.	2008
Water vole (*Arvicola ampihius*)	WCA	No records were provided by SEWBReC for water vole but information supplied by	2018

[23] EPS = European Protected Species as listed under Schedule 2 of the Conservation of Habitats and Species Regulations (2010)
WCA = Species protected under Schedule 5 (animals) or Schedule 8 (plants) of the Wildlife and Countryside Act (1981) as amended
[24] Only records from the last ten years are used.

Species / Group	Status [23]	Summary of Records	Year of nearest record[24]
		welsh government indicates that water vole are present 1.6 km to the east of the Site – however habitat is fragmented between the Site and the record locations.	
Badger (*Meles meles)*	BA	One record with the closest 1.8km east in Nash Road. Records supplied by the Welsh Government from Surveys associated with the new proposed M4 corridor suggest there are badger setts approximately 800 m away along the railway line to the east of the Site	2016
Hedgehog *(Erinaceus europaeus)*	WCA	SEWBReC returned seven records with the closest 1.5km north east on Nash Road.	2017

3.1.3.1 Birds

SEWBReC provided records of ten birds listed on Schedule 1 of the Wildlife and Countryside Act 1981 within the 2km search area from the last 10 years. Of these (listed in Appendix B in full), two are considered to have to potential to breed locally, Cetti's warbler (*Cettia cetti)* and little ringed plover (*Charadrius dubius).*

SEWBReC also provided numerous records of Section 7 birds. These are listed in full in Appendix B.

3.1.3.2 Section 7 Species

SEWBReC returned data on Section 7 species within the 2km search area. These included flowering plants: Deptford pink (*Dianthus armeria*) one record 756m from Site, Divided Sedge (*Carex divisa)* two records 1.1km from Site, Bird's-nest (*Monotropa hypopitys subsp. hypophegea*) one record 1.5km from the Site, Cornflower (*Centaurea cyanus*) one record 1.7km from Site. Fish species included: European eel (*Anguilla anguilla*), whiting (*Merlangius merlangus*), smelt (*Osmerus eperlanus*) and Atlantic salmon (*Salmo salar*) all 1.8km from Site. There are numerous Section 7 moth and butterfly species records, the closest is a record of a cinnabar moth (*Tyria jacobaeaeon*). Other insects include shrill carder bee 1km from Site and brown-banded carder bee (*Bombus humilis*) one record 1.5km from the Site.

3.2 Field Survey

3.2.1 Habitats – Extended Phase 1 Survey

A total of 17 habitats were identified within the Study Area; these are shown in **Figure 3 –** Extended Phase 1 Plan, and summarised below.

The Wales Coast Path runs from north west to south east through the Study Area and is aligned with the proposed flood embankment works, parallel to the River Usk. Saltmarsh interface and intertidal mud lay between the path and the river. Adjacent to either side of the path was poor semi improved grassland with scattered scrub including the following species: hawthorn (*Crataegus monogyna*), immature oaks (*Quercus sp.*), willow (*Salix sp.)*, bramble (*Rubus fruticosus*) and buddleia (*Buddleja davidii*). Ivy (*Hedera helix*) covered some of the trees.

At the northern end of the Site, there is a small area of swamp, dominated by common reeds, (*Phragmites australis*) and mud above mean high water on the western side of the path. On the eastern side of the path lies Coronation Park, which is managed as amenity grassland. There was little botanical diversity besides common grass species which included: perennial rye grass (*Lolium perenne*), bent grass (*Agrostis sp*.), annual meadow grass (*Poa annua*), Yorkshire fog (*Holcus lanatus*) and Timothy grass (*Phleum pratense*). Herbs included: white clover (*Trifolium sp*.), dandelion (*Taraxacum officinalis*) and plantain species (*Plantago spp*). This area is not likely to be affected by the proposed works. There are two stands of Japanese knotweed (TN3) south of this park as shown in Figure 3. Dense scrub surrounded a waterbody (waterbody 1 as shown in Figure 3) which was tidally fed and again had associated intertidal mud above mean high water and was dominated by common reed. Fencing continues along the length of the path and scrub transitions from scattered to dense along the footpath. This dense scrub encompasses a second waterbody (Waterbody 2) and associated ditch or reen.

There is an area of bare ground adjacent to a conveyor (TN1) which leads into the intertidal mud habitat. This conveyor bridges the path and leads into a sand spoil area directly opposite (TN2). There is another area of dense scrub on the northern side of the path which surrounds a small swamp area and area of open water (waterbody 3) and associated ditch. South of this, there is an area of hard standing, before another area of dense scrub surrounds further standing water (waterbody 4) with areas of swamp habitat. A small area of amenity grassland adjoins this habitat at the eastern extent of the Site.

3.2.2 Invasive plants

The Site was searched for evidence of invasive plant species listed under Schedule 9 of the Wildlife and Countryside Act 1981. Japanese knotweed was identified on the south boundary of the amenity grassland (TN3) and a stand was also seen next to the public footpath (TN3, Figure 3).

3.2.3 Phase 2 Botanical Survey

The National Vegetation Classification Survey (NVC) undertaken by Dr Peter Sturgess of Sturgess Ecology on the 15th August 2018, is provided in Annex A.

In summary, the plant communities recorded include:

- SM24 Sea couch *Elytrigia atherica* Saltmarsh (which covers the majority of the area surveyed). Notable species include Dittander (*Lepidium latifolium*) and marsh-mallow (*Althaea officinalis*).
- SM13/SM6 *Puccinellia maritima/spartina angelica* mosaic.
- S21 Seaclub rush *Bolboschoenus maritimus* swamp, S4 Common reed *Pragmites australis* reedbed. Notable species include long bracted sedge (*Carex extensa*).
- Fragmentary MG1 Mesotrophic neutral grassland, sparse vegetation on sandy ground, sparse vegetation on disturbed ground, dense scrub, scattered scrub.
- S4 *Phragmites australis* reedbed.
- Open vegetation communities on disturbed ground (TN2). Notable species include narrow everlasting pea (*Lathyrus sylvestris*)
- Fragmentary MG1 *Arrhenatherum elatius* grassland. Notable species include: common restharrow (*Ononis repens var horrida)*, Stone Parsley (*Sison apifera*) and Bee Orchid (*Ophrys apifera*).
- Grassland and scrub on flood bank (TN1). Notable species include black horehound (*Ballota nigra*) and stone parsley. Japanese knotweed is also present.
- Grassland and scrub on flood bank (TN4). Notable species include Viper's bugloss (*Echium vulgare*) and yellow-wort (*Blackstonia perfoliata*).

3.3 Species

3.3.1 Amphibians – Great crested newts

The waterbodies across the Site provide suitable breeding habitat for common amphibian species, e.g. common frog (*Rana temporaria*), common toad (*Bufo bufo*), palmate newt (*Lissotriton helveticus*), smooth newt (*Lissotriton vulgaris*) and the European protected great crested newt.

HSI were created for each waterbody on Site. The details of the HSI scores are reported in the table below.

Table 4: HSI for Waterbodies on Site.

Waterbody Number	HSI Score	Classification of HSI Score	Location
1	0	Unsuitable. Waterbody connected to the estuary through a culvert. The sea water is not considered suitable habitat for GCN due to the salinity.	ST32049 85904
2	Larger Pond HSI Score 0.53 Reen/Ditch HSI Score 0.67	Below average / Average	ST32385 85620
3	Larger Pond HSI Score 0.50 Reen HSI Score 0.49	Below average / Poor	ST32564 85509
4	Larger Pond HSI Score 0.49 Reen HSI Score 0.61	Poor / Average	ST32753 85431

3.3.1.1 eDNA

Although the HSI scores for the waterbodies were low, the presence of GCN could not be ruled out and NRW requested that eDNA surveys were undertaken. eDNA testing results were negative on waterbodies 1, 2 and 3 and associated drains indicating that GCN area absent from these waterbodies.

Samples from waterbody 4 had a positive result confirming the presence of GCN (see Appendix C). Further survey will be required to assess the population size (see Section 6).

Waterbody 3 and its associated drain is connected to waterbody 4 by terrestrial habitat in the form of dense scrub and both are within 250m of waterbody 4. Since GCN are known to regularly travel up to distances of 250m[25][26] it is possible that any GCN present within waterbody 4 could move between these waterbodies. Further surveys

[25] English Nature (2001) Great Crested Newt Mitigation Guidelines.
[26] Langton et al (2001) Great Crested Newt Conservation Handbook, Froglife.

are required to assess presence or absence in waterbody 3 and associated drain, in addition to population assessments of waterbody 4, and potentially waterbody 3.

Waterbodies 1 and 2 with associated drain are separated from waterbody 4 by a narrow area of gravel and concrete creating a barrier to movement of GCN between these waterbodies, in addition to being greater than 250m from waterbody 4, and therefore no further surveys of these waterbodies are proposed.

3.3.2 Bats

No potential roost features in trees or structures were identified within the Site during the Extended Phase 1 survey. The Site is bordered to the east by industrial developments and residential housing in the wider area which may support roosting bats. Therefore, roosting bats are not considered to be a constraint to the works.

The Site has potential to support foraging and commuting bats that may be roosting in the surrounding area due to the presence of dense scrub, waterbodies and linear features; e.g. scrub along the public footpath.

3.3.3 Badgers

No signs of badger were observed on Site during the Extended Phase 1 survey and the scrub offered little habitat for sett creation, given the relatively high-water table. However, the scrub was too dense to check in detail so some scrub clearance was carried in March, overseen by an experienced ecologist for the purpose of a topographic survey. This offered further access in order to fully assess the area for badger setts. No evidence of badgers or setts were recorded and badgers are therefore not considered to be a constraint to the proposed works.

3.3.4 Birds

One Schedule 1 species, Cetti's warbler was incidentally observed singing during the Extended Phase 1 Survey and during Phase 2 surveys. Observation on subsequent surveys, suggests that the Cetti's warbler is breeding at the Site likely within the reeds at the Site.

There is a variety of habitat including scrub and swamp on Site to support a range of other breeding birds.

3.3.5 Dormice

The brambles and scrub on Site provide suitable foraging and nesting habitats for dormice. However, fragmentation from other potential dormouse habitat including those with dormouse records within the wider area due to barriers such as roads, rivers and rail means dormouse are unlikely to occur within the Site and therefore are not considered to be a constraint to the proposed works.

3.3.6 Reptiles

The mosaic of wetland habitats, such as swamp with scrub and open areas of semi-improved grassland provide suitable habitat for reptiles specifically common lizard, slow worm and grass snake.

Despite suitability of habitat, no reptiles were recorded during the reptile surveys carried out between 10th May 2018 and 19th July 2018.

3.3.7 Otters and Water Vole

No signs of otter or water vole were observed during the Extended Phase 1 Survey, or during additional surveys including ecological watching briefs and checks undertaken during reptile surveys.

The Site has moderate potential to support water vole in areas where common reeds line the ditches and the waterbodies which will provide suitable food resource and refuge.

The Site has potential to support otters due to presence of waterbodies which include connecting habitats to scrub and the river. This could provide foraging opportunities for otters. The Site, however is used by dog walkers and this may negatively impact the potential for otters to breed on Site.

During the Extended Phase 1 Habitat survey flattened reeds forming paths in and around the second swamp from the north were noted, which may be indicative of otters. Two otter cameras set up at this location to confirm any otter activity, between 18th April 2018 and 19th July 2018, however these recorded only rats and foxes, as shown in Photography 1 and did not record any evidence of otter or other protected species.

3.3.8 Invertebrates

The Site lies within the River Usk SAC and SSSI, which is designated in part for its important invertebrate communities, including aquatic species. It is considered likely that there would be a moderate range of invertebrate species present due to the range of habitats on Site. Species rich habitats, in particular those within the SAC / SSSI designation may also support more significant populations and or notable species including species which are associated with the designations.

3.3.9 Other Mammals

Rabbit (*Oryctolagus cuniculus*) paths and droppings were found close to the path in the south. Due to the habitat types identified on Site, hedgehogs (*Erinaceus europaeus*) may also be present

3.3.10 Fish

No species survey was undertaken for fish species present within the River Usk or Seven Estuary as part of this assessment. Presence is assumed at the relevant times of year for each species due to the River Usk and River Severn designations

for: sea lamprey (*Petromyzon marinus*), river lamprey (*Lampetra fluviatilis*), brook lamprey (*Lampetra planeri*), allis shad (*Alosa alosa*), twaite shad (*Alosa fallax*), Atlantic salmon (S*almo salar*) and bullhead (*Cottus gobio*).

4 Evaluation of Ecological Receptors

This section initially evaluates the nature conservation importance of the habitats and species present within the Study area in terms of their importance in an international, national, county, local and less than local or Site context as per the geographic scale identified in Section 2.4.1. Table 6 below evaluates all the ecological resources present or potentially present within the Site.

It is considered that dormice are not present within the Site due to a lack of suitable connective habitat and therefore they have not been valued in the context of nature conservation.

Table 6: Nature Conservation Evaluation of Ecological Receptors at the Site.

Ecological Feature	Evaluation	Conservation in the context of the Development
Designated Sites		
River Usk SAC	International	The Site falls within the designated area. Designated for internationally important riverine habitat and assemblages of fish.
River Usk SSSI	National	The Site falls within the designated area. Designated for internationally important riverine habitat and assemblages of fish.
Severn Estuary SAC & SPA	International	The designated area lies approximately 1.5 km to the south of the Site. It is important for its rare estuarine communities, migratory fish species and bird assemblages.
Severn Estuary SSSI	National	This SSSI is a component part of the Severn Estuary SPA and SAC. It is designated for its intertidal and saltmarsh habitats and assemblages of important waterfowl, invertebrate and migratory fish populations.
Gwent Levels: St Brides & Nash and Goldcliff SSSIs	National	The Gwent Levels are approximately 1.6 km to the east and west of the Site respectively. They are drained by an ordered network of drainage ditches which support rich plant and invertebrate communities.
Newport Wetlands National Nature Reserve	National	The designated area lies approximately 1.5 km to the south of the Site, adjacent to the Severn Estuary and close to the mouth of the River Usk.

Ecological Feature	Evaluation	Conservation in the context of the Development
		The Site supports nationally important numbers of overwintering birds and breeding birds in the summer. The Site supports diverse invertebrate populations and a diverse range of botanical species within the drainage ditches.
Marshalls SINC	County	The Marshalls SINC (ST321857) lies within the Site boundary and is notified for its mosaic of habitats including scrub and tall ruderal, post-industrial land, neutral grassland and wetland along the banks of the Usk.
Habitats		
Saltmarsh, intertidal mud and swamps	International	Saltmarsh, intertidal mud and swamps are habitats identified within the Site which form part of the River Usk SAC and SSSI. Consequently, these habitats are of International importance. There is potential for loss and disturbance of these habitats due to pollution events during construction. Other habitats present within the Site, which lie outside of the SSSI / SAC boundary such as amenity grassland, semi improved grassland or scrub are of value at Site level only.
Amenity grassland, semi improved grassland and scrub	Local	These habitats lie outside of the SSSI / SAC boundary and therefore provide ecological value at a Local level for the species they support.
Species		
Foraging and commuting bats	Local	Under BCT guidelines the Site is of low quality habitat for roosting bats and low to moderate quality for commuting and foraging. There are no potential roost features at the Site.
Nesting birds (common species)	Local	Habitat at the Site such as reeds, scrub, trees and swamp vegetation provide suitable habitat for nesting birds including Schedule 1 species.
Great crested newts	Potentially up to County	The presence of GCN at the Site has been confirmed by eDNA sampling and analysis at waterbody 4 which is connected to waterbody 3.

Ecological Feature	Evaluation	Conservation in the context of the Development
		Further survey will enable assessment of population size in waterbody 4 and connecting waterbodies and confirm the valuation of the species in the context of the development.
Otter	Local if present	No evidence or footage of otters was recorded during April to July 2019, but the Site does offer suitable habitat for foraging and commuting otter and due to the mobility of the species it is not possible to rule out their presence. Potential resting places, although breeding unlikely due to disturbance.
Water vole	Local if present	No evidence of water vole was recorded at the Site however the ditches and waterbodies at the Site do offer suitable habitat and water vole are known to be present further east of the Site.
Badger	Site	No evidence of badger was recorded on site however scrub and grassland offer suitable habitat for this species.
Reptiles	Site	Although reptiles were not recorded during the Surveys, the Site offers suitable habitat and therefore it is not considered possible to rule out presence of reptiles. However likely to be present in very low numbers.
Invertebrates	County	The Site lies within the River Usk SAC and SSSI, which is designated in part for its important invertebrate communities, including aquatic species. It is possible that notable species are present including species which may be associated with these designations.
Fish: sea lamprey, river lamprey, brook lamprey, allis shad, twaite shad, Atlantic Salmon, and bullhead	International / National	These fish are all qualifying features of the River Usk SAC. The works are not planned to occur within 30 m of the River.
Non- native invasive species	Negligible	Japanese knotweed has been recorded within the Site. This species has no ecological value, but as a Schedule 9 species under the Wildlife and Countryside Act 1981, requires measures to avoid disturbance and spread within/from the Site.

5 Assessment of Potential Effects

There is potential for impacts on designated sites, habitats and protected or notable species during the construction and operation of the flood embankment works.

Potential impacts may be direct or indirect and categorised as follows;

- Species mortalities and injuries;
- Habitat degradation including pollution and sedimentation;
- Habitat loss and disturbance;
- Disturbance to species and habitats; and
- Habitat fragmentation and physical restrictions to species movements.

5.1 Construction

Designated Sites

There are four European designated sites potentially impacted: including River Usk SAC within the Site, and Severn Estuary SAC, Ramsar and SPA within 5km. There are five Nationally designated sites: including River Usk SSSI within the Site, Severn Estuary SSSI, Gwent Levels (Goldcliff and St Brides) and Newport Wetlands NNR within 5km.

There is also a Local designation: Marshall's SINC which occurs within the northern extent of the Site.

Where works are within designated sites; i.e. the River Usk SAC/SSSI, and Marshall's SINC, there is the potential for habitat loss and disturbance. Habitats recorded during the Extended Phase 1 survey and botanical survey within Marshall's SINC and therefore also within the River Usk SAC include scattered and dense scrub, mesotrophic grassland, *Eltirigia atherica* saltmarsh and sparse vegetation on sandy ground. Habitat predominantly within the River Usk SAC are the saltmarsh, *Bolboschoenus maritimus* swamp, P*hragmites australis* reedbed and SM13 *Puccinellietum maritimae*/SM6 *Spartina angelica* mosaic closest to the river edge.

There is the potential for direct impacts to the habitats within these designated sites and their habitats, through physical disturbance as well as indirect impacts through pollution events.

There is also the potential for direct and indirect impacts to the qualifying species of these designated sites, including fish and otter, and which are discussed in 'Species' section below.

Any impacts to the River Usk SAC and SSSI would be of international/national significance, and to the Marshalls SINC would be of County significance.

A draft Habitat Regulation Assessment (HRA) screening report[27] has been prepared in consultation with NRW based on the outline works, which identifies potential pathways for effect on the SAC qualifying features: sea lamprey, river lamprey, twaite shad, Atlantic salmon, and otter. Any effects on the qualifying features: watercourses of plain to montane levels with *Ranunculion fluitantis* and C*allitricho batrachion* vegetation, brook lamprey and bullhead are screened out due to not occurring within the management unit of the SAC within which the Site occurs.

The draft HRA screens out potential effects on the Severn Estuary SAC, Ramsar Site and SPA due to spatial separation, and any fish species which are qualifying features of the Severn Estuary; due to being considered as a feature of the River Usk SAC.

No direct effects on the River Usk SAC are considered likely. There are potential indirect effects from pollution events during construction relating to water quality and disturbance, including potential mobilisation of sediment, pollution incidents and disturbance of vibration sensitive fish and otter. Mitigation measures are discussed within the document and include the use of standard best practice pollution control techniques, avoiding working within the swamp and reed bed habitat within 30m of the watercourse, the use of bog mats when working within SAC habitats, re-instatement of SAC habitats, avoidance of overnight lighting/noise and covering excavations. In addition, there is the potential for barriers to otter movement as a result of sheet piling between the river and scrub, although access would be possible at two locations. The installation of sheet piling may however be beneficial to otter using the foreshore, as it will reduce access by dog walkers and therefore potential disturbance.

As a result of new case law[28], the above mitigation measures cannot be included within the Screening Stage of HRA, and therefore it is likely that any potential pathways for effect will need to be evaluated within an Appropriate Assessment (see Section 6.1)

Habitats

A range of habitats, such as sea couch dominated saltmarsh, saltmarsh mosaic with cord grass and saltmarsh grass, reedbeds, mesotrophic grassland and hawthorn scrub have been recorded within the site, which may be lost or disturbed during construction. With the exception of habitats within designated sites as discussed above, habitats such as scrub, amenity grassland or sparse vegetation on bare of sandy soil are not species rich and do not have more than local value. Any impacts would have no more than local significance. Mitigation will be required to avoid disturbance where possible, as well as of neighbouring impacts on

[27] Arup (2016) Stephenson Street Embankment Flood Risk Management Project Habitat Regulation Assessment Form 1.
[28] People over Wind, Case C323/17 European Court of Justice, 12th April 2018

habitats within designated sites; i.e. the implementation of standard pollution control measures and to restore habitat once construction is completed.

Species

There is potential for injury or mortality to species confirmed as being present within the Site, and in proximity, including nesting birds (including Schedule 1 birds), great crested newts and fish. In addition, it is possible that common reptile species, invertebrates, otter, water vole and badger which may occur within the vicinity of the site, could also be subject to injury and mortality during construction. Injury and mortality could occur as a result of vegetation clearance, trampling by machinery, direct collision with construction vehicles, and or entrapment within excavations. A European Protected Species (EPS) licence will be required for any works which are likely to harm GCN or disturb their habitat including breeding ponds and connecting terrestrial habitat.

There is potential for disturbance through noise and vibrations to species present at the Site especially fish species within the River Usk, Schedule 1 bird species and otters. There is also potential for disturbance to commuting bats and otter at the Site if any overnight lighting is used during the construction period.

There is the potential for habitat loss, to species occurring within the Site including nesting birds if clearance occurs during the nesting bird period as well as potentially otter, reptiles, water vole, badger and invertebrates during construction. It is acknowledged that the majority of habitat loss will be temporary and habitats will be re-instated post construction. Furthermore, there is suitable habitat for nesting birds, and other species such as reptiles/badger within the wider area.

Vegetation clearance and construction may fragment habitats and create barriers to movement by some species in particular to otter, GCN and foraging bats which are known to rely on habitat corridors for dispersal. As above, it is anticipated however that disturbed/removed habitats will be re-instated post construction.

Any impacts to otter and fish would be of international significance, since these species are qualifying features of the River Usk, and Severn Estuary SAC.

Impacts to GCN are considered to be of up to county significance (depending on further survey data), and other species any impacts would be of no more than local significance. Mitigation will be required for these species to ensure adherence with UK and European legislation.

5.2 Operation

As discussed above, the draft HRA screening document details potential impacts on otter post construction as a result of sheet piling which may reduce habitat connectivity for otter between the river and scrub along the embankment. There are two access locations proposed however which coincide with scrub habitat along the embankment, and which will therefore allow continued access by this species.

Furthermore, the sheet piling is considered likely to reduce disturbance for any otter using the river and adjacent bank, since it will be less accessible for dogwalkers and therefore subject to less disturbances.

None of the other elements of the construction will result in impacts during operation for example no permanent lighting is proposed.

6 Recommendations

Recommendations for further consultation, further species surveys or general best practice mitigation to minimise impact of the scheme on habitat and species are stated below.

6.1 Pre-construction

Designated Sites

- A draft Habitat Regulation Assessment (HRA) screening report[27] has been undertaken in 2016, however this was prior to a court ruling which has led to omission of all mitigation from the screening stage of potential impacts. Therefore, an Appropriate Assessment will be required which will take into account the updated Phase 2 survey results and the proposed mitigation to assess likely significant effects on internationally designated sites.
- For any planning applications, the Local Planning Authority will also require a copy of the updated Appropriate Assessment as it assumed they would become 'competent authority'.
- Consultation will be required with relevant teams within NRW regarding impacts on the River Usk SSSI, and SSSI assent required for construction.
- The LPA will need to be consulted regarding impacts on Marshall's SINC.

Species

6.1.1 GCN Population Surveys

eDNA sampling confirmed the presence of GCN at the Site within waterbody 4.

- Six GCN population surveys will be carried out on waterbody 4 between mid-March and mid-June 2019, with at least three surveys being undertaken between mid-April and mid-May.
- Four surveys will be carried out on waterbody 3 and associated ditch, with two between mid-March and mid-June 2019. If newts are recorded within the first four surveys, an additional two surveys will be carried out to assess the population size as per the method above.

A European Protected Species (EPS) licence will be required for any works which are likely to harm GCN or disturb their habitat including breeding ponds and connecting terrestrial habitat. This will be informed by the additional presence / absence and population assessment in addition to a risk assessment which will be undertaken of all activities within 500m of confirmed GCN records to determine likely impacts.

6.1.2 Otter and Water Vole

The design phase of the project must ensure that gaps are left in the sheet piling so that otters continue to have access between the embankment habitat and the river.

Due to the presence of suitable habitat for otter and water vole within the site, and that they are both mobile species it is recommended that an additional pre-construction survey (at least 10 weeks prior to construction) for both species is undertaken between April and September, of all suitable habitat within 30m of the works.

Works will need to avoid disturbance within 8m of water vole habitat and or 30m of otter resting places. If any water vole habitat / otter resting places are found, and are likely to be disturbed by the works a licence will be required from NRW.

6.1.3 Badger Survey

Given the mobile nature of this species and dense scrub present, ecological supervision is recommended for any vegetation clearance ahead of construction to ensure no setts are present.

If any setts are found, a disturbance licence will be required from NRW for any works within 30 m of the sett and buffers implemented to reduce disturbance from any vibration.

6.2 Construction

6.3 Habitats (within the SAC/SSSI)

Recommendations are made in the botanical survey report included in Annex A with regard to protection and re-instatement of valuable habitat at the Site. In summary, recommendations made are as follows:

- Construction should minimise works within 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.
- Specific notable plants (such as bee orchid) or areas to be protected if they are on the margins of the Site, should be identified/demarcated on Site during construction using temporary fencing (i.e. Heras fencing). If they cannot be retained, uncommon plants could be translocated to areas of suitable habitat off Site.

- The new embankment should use similar soil as used previously to enable recolonization of similar flora.
- A habitat management plan for the embankment should be agreed to prevent scrub encroachment and loss of species diversity as has currently happened.
- It is also recommended that the saltmarsh should be subject to periodic litter collections[29]. 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.

The HRA screening document[27] also states that construction access will be restricted to the toe of the embankment on a c. 3m wide temporary access track, anticipated to be bog mats or similar. This is considered sufficient to avoid permanent effects on the saltmarsh habitat.

6.4 Habitats (outside of the SAC/SSSI boundary)

Best practice guidelines will be implemented for all works in proximity to a watercourse.

- No works will be undertaken within 30m of the MHWS limit to prevent change to the flow regime or physical habitat.
- A Construction Environmental Management Plan (CEMP) will be maintained by the contractor which will include Site-specific methods to ensure that all Site activities, especially those in proximity to watercourses and waterbodies are controlled and are in accordance with relevant legislation and undertaken in compliance with the relevant Guidance for Pollution Prevention (GPPs) and industry best practice (GPP5[30], CIRIA[31])
- Where possible any disturbed habitats will be re-instated post construction, and re-seeded/ planted with an appropriate seed/plant mix or left to revegetate naturally, as approved by NRW.

6.5 Species

6.5.1 Bats

The Site does not provide any roosting opportunities for bats but does provide suitable foraging habitat.

- All works will be carried out during daylight hours (typically up to 30 mins before sunset and 30 minutes after sunrise) within the main active period

[29] Natural Resources Wales are participating in a litter pick in September 2018.
[30] Natural Resources Wales (NRW), the Northern Ireland Environment Agency (NIEA), Scottish Environment Protection Agency (SEPA) (2018). Guidance for Pollution Prevention – Works or maintenance in or near water: GPP5 v1.2 Feb 2018. http://www.netregs.org.uk/media/1418/gpp-5-works-and-maintenance-in-or-near-water.pdf (accessed 07.08.18)
[31] CIRIA (2018) CIRIA http://www.ciria.org (accessed 07.08.18)

(April to October) where possible to avoid disturbance to commuting or foraging bats.

- Any task lighting required for health and safety or security reasons will be directional lighting (towards the ground) to avoid light spill onto habitats immediately within or adjacent to the Site

6.5.2 Breeding Birds

- All vegetation clearance of suitable bird nesting habitat is undertaken outside of the core bird nesting season (the bird nesting period is 1 March to 31 August, subject to regional and seasonal variations) to avoid damage or destruction of occupied nests or harm to breeding birds. If this cannot be achieved, works within the core bird nesting season will require an inspection of vegetation to be cleared for breeding birds and their occupied nests by a suitably qualified ecologist no more than 24 hours prior to any works commencing. If any nesting birds are identified during the survey they will be left in situ for their entire nesting period and alternative approaches to the work proposed. This may include leaving an exclusion zone around the nests to avoid disturbance.

If any schedule 1 birds such as the Cetti's warbler are nesting on the Site at the time of construction a larger buffer between construction and nests of these species as advised by a suitably experienced ecologist.

6.5.3 Otters

Although no evidence of otter was recorded, due to the mobility of this species, suitable habitat, and known records in the area, the following mitigation will be implemented to minimise impact on otter.

- Good practice working methods will be adhered to which to prevent any adverse impact to otters; i.e. materials will not be left overnight in an area accessible to otters and excavations will not be left uncovered overnight. If any excavations are required to be left open overnight, a ramp will be created to allow any animals to escape, including other mammals at the Site.

- Access for otters along all waterbodies will be maintained during construction and operation through the natural gaps provided by transitions between sheet piling and raised embankment (i.e. at Coronation Park and the conveyor), thus ensuring that movement of otter is not impeded during operation of the proposed works.

- All works will be carried out during daylight hours (up to 30 minutes after sunrise and 30 minutes before sunset) where possible to avoid disturbance to commuting or foraging otters. Any use of task lighting will be directional to avoid illumination of the river corridor at night.

If any otter resting places are found during pre-construction checks, additional mitigation measures may also be required to reduce disturbance.

6.5.4 Invertebrates

Habitat disturbance and loss will be minimised where possible to avoid loss of habitat for invertebrate communities, both terrestrial and aquatic for which the River Usk SSSI is designated. If habitat loss cannot be avoided it will be re-instated using species composition similar to that discussed within the botanical survey report[32] (Annex A).

6.5.5 Invasive Plants

Japanese knotweed was recorded during the survey. An eradication plan for treating Japanese knotweed by stem injection is commencing in October 2018 and will be repeated in 2019 to prevent it spreading as advised by NRW. An invasive species management plan will be produced within the contractor Risk Assessment and Method Statement (RAMS) document, containing Site-specific methods to ensure that all Site activities are controlled and are in accordance with best practice procedures as mitigation. A pre- construction survey will be carried out to further inspect for invasive species and confirm its distribution.

6.5.6 Fish

The HRA screening report recommended, in consultation with NRW, the following working methods to prevent impact to the fish species present in the River Usk.

- All piling works will be undertaken beyond the recommended threshold for effect; i.e. more than 30m from the Mean High-Water Springs (MHWS) limit, and will therefore be in accordance with NRW advice.

[32] Sturgess, P. (August 2018) Stephenson Street Embankment, Newport – Vegetation Survey

7 Summary and Conclusions

The Site is situated within The River Usk SAC and SSSI supporting important habitats such as saltmarsh, and intertidal habitat and otter, species assemblages of fish and invertebrates of international and national importance. The Site is also entirely within the locally designated Marshalls SINC. The Site also occurs within 5km of other designated sites including the Severn Estuary SAC, SPA, Ramsar site, and SSSI, Gwent Levels SSSI, and Newport Wetlands NNR.

An Appropriate Assessment will be required in consultation with the competent authority to assess any likely significant effects on the River Usk SAC and the River Severn SAC, SPA and Ramsar sites taking into account proposed mitigation. In addition, a SSSI assent will be required from NRW prior to any works being undertaken within the SSSI. Consultation will also be required with the LPA on any potential impacts to Marshalls SINC.

Recommendations have been made regarding the protection of the designated sites qualifying features.

The Site also supports a range of other habitats such as scrub, grassland, reedbeds and swamps which may not be of great ecological value in themselves, but for the species they support including EPS such as great crested newts, and Schedule 1 birds such as the Cetti's warbler. There is also the potential for other species such as otter, badger and water vole to occur within habitats on site.

Additional great crested newt surveys are required to inform any specific mitigation or habitat enhancement and an NRW licence is required prior to any works likely to disturb GCN and or their habitats. Further surveys are also recommended for badger, water vole and otter, as a precautionary approach to ensure they are not present during the works, in particular during vegetation clearance. Additional mitigation measures may be required if they are found, and potentially licences from NRW for disturbance.

General mitigation is recommended during construction to protect existing habitat and species such as bats, birds, invertebrates, otters and fish.

In addition, mitigation is recommended for the treatment of Japanese knotweed, to avoid its spread within/from the Site.

The implementation of the above recommendations, will reduce construction impacts to an insignificant level. Potential operational impacts such as barriers to otter movement as a result of the sheet piling, will be avoided by maintaining access at certain locations along the embankment. There will be no other operational impacts.

This report is the result of survey work undertaken between March 2018 and July 2018. This report refers, within the limitations stated, to the condition or proposed development of the site at the time of the inspections. Changes in legislation, guidance, best practice, etc. may necessitate a re-assessment/survey. It is also

advised that if there is a delay of over a year in undertaking the works, an updated walkover survey is recommended to ensure the baseline conditions have not changed. No warranty is given as to the possibility of future changes in the condition of the site.

This report is produced solely for the benefit of NRW and no liability is accepted for any reliance placed on it by any other party. This report is prepared for the proposed uses stated in the report and should not be used in a different context.

Figures

Figure 1. Aerial image showing Site Extent

A3

Red Line shows Site Extent

25/11/2015 14:24:01

Issue	Date	By	Chkd	Appd
F1	2015-11-24	JL	JL	DR

Metres
0 50 100 200

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Client

Natural Resources Wales

Job Title

Stephenson Street Embankment

Site Location

Scale at A3

1:4,000

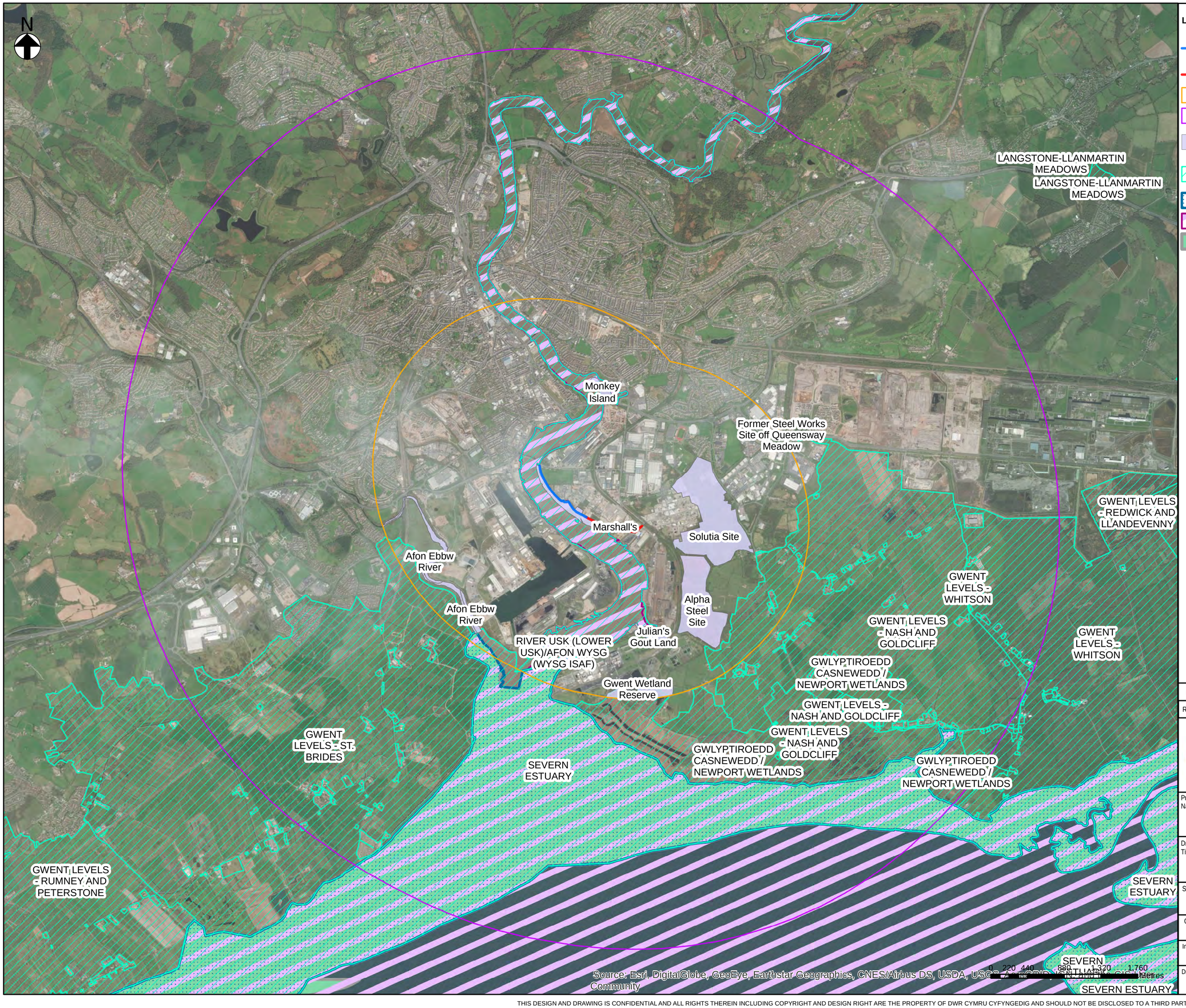
Job No	Drawing Status
245404	**Preliminary**

Drawing No	Issue
Figure 1	**F1**

\\globa\europe\Cardiff\Jobs\245000\245404-00\4 Internal Project Data\4-80 GIS\4-84 Map Documents\GEO_Geotechnics\DeskstudyJKL.mxd

Figure 2.

Statutory and Non-Statutory Designated Sites



LEGEND

A3

- Phase 1 Works- Flood Defence Improvements
- Phase 2 Works
- 2km works buffer
- 5km works buffer
- Sites of Importance for Nature Conservation (SINC)
- Sites of Special Scientific Interest (SSSI)
- Special Protection Areas (SPA)
- Special Areas of Conservation (SAC)
- Ramsar

ARUP

Rev.	Date.	Drawn.	Description.	Chkd.	Appd.	Date.
P0	2018-07-24	EA	Preliminary	GM	PC	2018-07-24

Cyfoeth Naturiol Cymru Natural Resources Wales

Project Name.
Stephenson Street Embankment

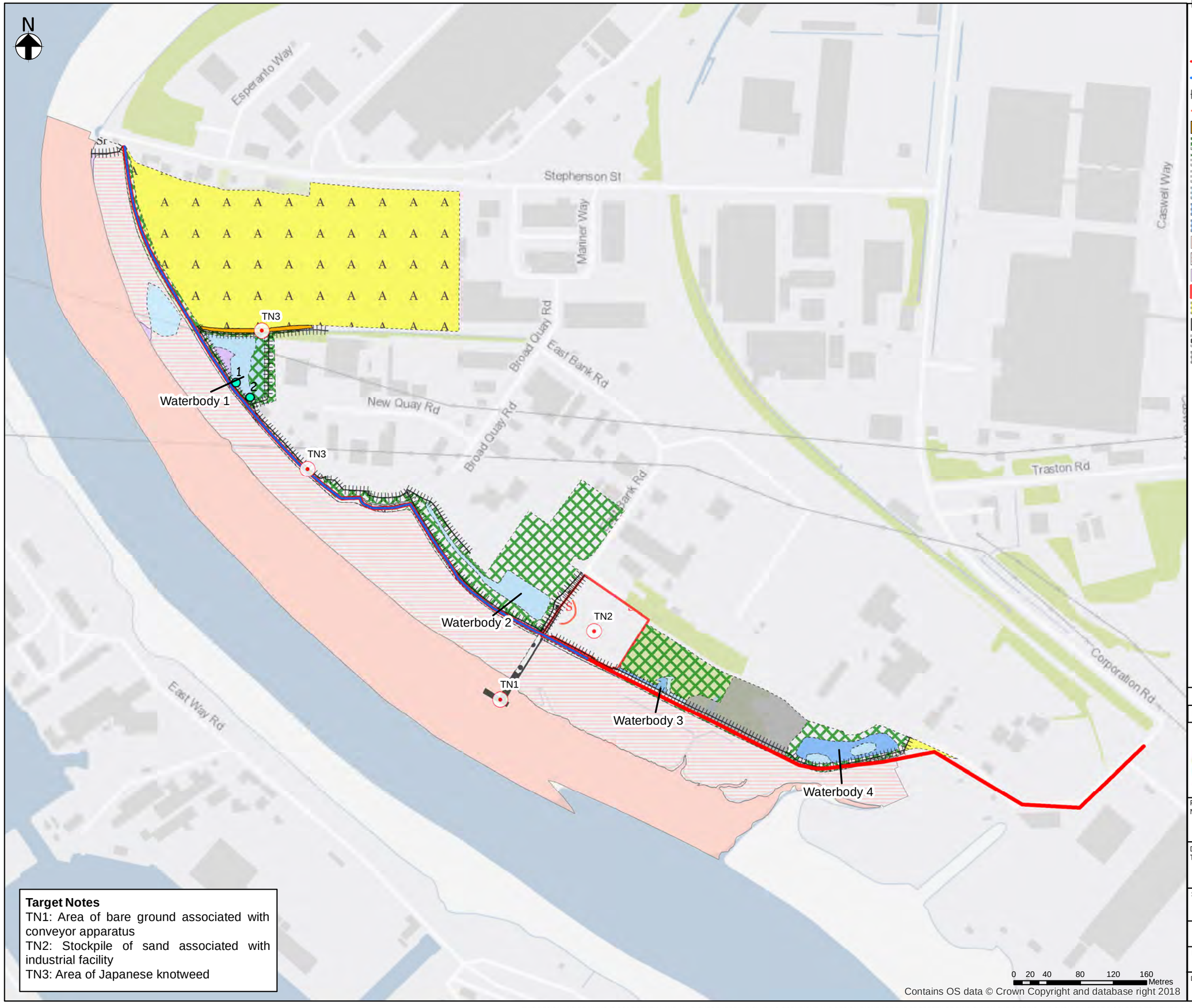
Drawing Title.
FIGURE 2
STATUTORY AND NON-STATUTORY DESIGNATED SITES

Suitability.	Suitability Code.
Preliminary	2018-07-24

Originator	Designer	Date.
EA	GM	2018-07-24
Internal Project Number	**Scale**	**Rev.**
245404	1:41,990	P0

Drawing Number.
002

Figure 3. Extended Phase 1 Habitat Survey Results showing Ecological Target Notes and location of Otter cameras



Target Notes
TN1: Area of bare ground associated with conveyor apparatus
TN2: Stockpile of sand associated with industrial facility
TN3: Area of Japanese knotweed

Legend

A3

- Target note
- Otter Camera Locations
- Phase 2 Works
- Phase 1 Works- Flood Defence Improvements
- Fence
- Wall
- Japanese knotweed
- Dense scrub
- Scattered scrub
- Poor semi-improved grassland
- Swamp
- Standing water
- Running water
- Intertidal mud/sand
- Saltmarsh dune interface
- Mud/sand above mean high water
- Spoil
- Amenity grassland
- Buildings
- Bare ground
- Gravel and concrete

ARUP

Rev.	Date.	Drawn.	Description.	Chkd.	Appd.	Date.
P0	2018-05-21	EA	Preliminary	GM		2018-07-24

Cyfoeth Naturiol Cymru
Natural Resources Wales

Project Name.
Stephenson Street Embankment

Drawing Title.
FIGURE 2
EXTENDED PHASE 1 PLAN

Suitability.	Suitability Code.
Preliminary	2018-05-21

Originator	Designer	Date.
EA	GM	2018-05-21

Internal Project Number	Scale	Rev.
245404	1:4,250	P0

Drawing Number.
002

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Photographs

Photograph 1: Camera footage of a fox from camera 1 at waterbody 1.

c

Photograph 1: Camera footage of a fox from Camera 1 at Waterbody 1 on the 7th April 2018 at 22.37. No otters were recorded.

Appendix A

A1: Legislative Context

A1 Legislative Context

A framework of international, European, national and local legislation and planning policy guidance exists to protect and conserve wildlife and habitats. This is described in the following sections. The reader will refer to the original legislation for the definitive interpretation.

A1.1 Statutory Designated Sites

A network of nationally designated Sites has been established through the designation of Sites of Species Scientific Interest (SSSI) under the Wildlife and Countryside Act 1981 (as amended). The protection afforded by the Act means it is an offence to carry out or permit to be carried out any operation listed within the notification without the consent of the Statutory Nature Conservation Organisation[33] (Natural Resources Wales).

The protection afforded to SSSIs is used to underpin the designation of areas at a European Level. European Sites comprise:

- Special Areas of Conservation (SAC) designated under the Conservation of Habitats and Species Regulations 2010 (as amended) (known as the Habitats Regulations);
- Special Protection Areas (SPA) designated under the Wildlife and Countryside Act.

Wetlands of International Importance (Ramsar Sites) declared under the Convention on Wetlands of International Importance especially as Waterfowl Habitat 1971 are normally also notified as SSSIs but are only considered European Sites as a matter of UK and Local Government Policy.

The Habitats Regulations transpose the requirements of Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (the Habitats Directive) in to law within England and Wales, while the Wildlife and Countryside Act transposes Directive 79/409/EEC on the Conservation of Wild Birds (the Birds Directive) in the law within England and Wales. Equivalent legislation exists to transpose these directives in the law within Scotland and Northern Ireland.

The Habitats Regulations require that consideration is given to the implications of plans and projects (developments) on European Sites are considered. Specifically, Regulation 61(1) states:

"*A competent authority, before deciding to undertake, or give any consent, permission or other authorisation for, a plan or project which –*

(a) is likely to have a significant effect on a European Site or European marine Site (either alone or in combination with other plans or projects), and

[33] Section 28 of the Wildlife and Countryside Act 1981 (as substituted by Schedule 9 of the Countryside and Rights of Way Act 2000).

(b) is not directly connected with or necessary to the management of that Site, must make an appropriate assessment of the implications for that Site in view of that Site's conservation objectives."

The formal consideration of effects on European Sites is therefore undertaken by the determining authority such as the Local Planning Authority.

Local Nature Reserves can be given protection against damaging operations through powers within the National Parks and Access to the Countryside Act 1949 (as amended). However, this protection is usually conveyed through inclusion of protection within local planning policy relating to these Sites and other non-statutory Sites such as Sites of Importance for Nature Conservation.

A1.2 European Protected Species

The Habitats Regulations convey special protection to a number of species which are listed in schedule 2 of the Regulations and are referred to a European Protected Species (EPS):

- All UK resident bat species;
- All whale and dolphin species;
- Large blue butterfly (*Maculinea arion*);
- Common dormouse (*Muscardinus avellanarius*);
- Pool frog (*Rana lessonae*);
- Sand lizard (*Lacerta agilis*);
- Fisher's estuarine moth (*Gortyna borelii lunata*);
- great crested newt (*Triturus cristatus*)
- common otter (*Lutra lutra*)
- wild cat (*Felis silvestris*);
- Lesser Whirlpool Ram's-horn Snail (*Anisus vorticulus*)
- Smooth snake (*Coronella austriaca*);
- Sturgeon (*Acipenser sturio*);
- Natterjack toad (*Bufo calamita*); and
- All marine turtles.

Regulation 41 makes it an offence to:

a) Deliberately capture, injure or kill any wild animal of a EPS;

b) Deliberately disturb wild animals of such a species;

c) Deliberately takes or destroys the eggs of such a species;

d) Damages or destroys a breeding Site or resting place of such an animal.

Disturbance in the context of the offences above is disturbance which is likely to impair the ability of the animals to survive, to breed or reproduce, to nurture their young, to hibernate, to migrate; or to affect significantly the local distribution of the species.

Licences can be granted by the relevant SNCO for developments (sometime referred to as EPS Licences or Derogation Licences) providing the purposes of the licence is for "*preserving public health or public safety or other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment*".

A1.3 UK Protected Species

The Wildlife and Countryside Act 1981 provide protection to both EPSs and other species including wild birds, water voles and reptiles.

All wild birds, their nests and eggs are protected with some rare species afforded extra protection from disturbance during the breeding season (these species are listed in Schedule 1 of the Act). It is illegal to take any wild bird or damage or destroy the nests and eggs of breeding birds. There are certain exceptions to this in respect of wildfowl, game birds and certain species that may cause damage.

Water vole receive protection under the Wildlife and Countryside Act 1981 which prohibits the killing, injuring or taking by any method.

All native reptile species in the UK are subject to partial protection from intentional or reckless killing or injury only.

Badger and their setts are protected under the Protection of Badgers Act 1992 which makes it an offence to kill, injure or take a badger, or interfere with a sett.

A1.4 Other Legislation Relating to Species

Section 6 of the Environment (Wales) Act 2016 includes a duty on all public authorities to "seek to maintain and enhance biodiversity" so far as it is consistent with the proper exercise of those functions. In so doing, public authorities must also seek to "promote the resilience of ecosystems". This duty applies to government bodies, local authorities and statutory undertakers.

To assist in complying with this duty, public authorities must have regard to relevant evidence provided in the State of Natural Resources Report and any relevant area statement for an area in which the authority exercises functions, as well as having regard to the list of living organisms and habitats published under Section 7 of the Act. Species and habitats listed on Section 7 are considered to be of Principal Importance for the conservation of biological diversity.

The Environment (Wales) Act 2016 replaces the NERC Act 2006; Section 6 replaces Section 40 of the NERC Act and Section 7 replaces the Section 42 lists.

Appendix B

B1: Designated Sites Citations
B2: Non-designated Sites Citations
B3: SEWBReC Desk Study Birds Records

B1: Statutory designated Sites within 5km and 2km of the Site boundary, for European and national Sites, respectively. Designated features are taken from NRW's website and the corresponding citations/data forms.

Site Name	Features	Distance from Proposed Development
European Protected Sites		
River Usk Special rea of Conservation (SAC)	Annex I habitats present as a qualifying feature, but not a primary reason for selection of this Site: Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation. Annex II species that are a primary reason for selection of this Site: Sea lamprey (*Petromyzon marinus*), brook lamprey (*Lampetra planeri*), river lamprey (*Lampetra fluviatilis*), twaite shad (*Alosa fallax*), atlantic salmon (*Salmo salar*), bullhead (*Cottus gobio*) and otter (*Lutra lutra*). Annex II species present as a qualifying feature, but not a primary reason for Site selection: Allis shad (*Alosa alosa*)	Within Site boundary
Severn Estuary Ramsar Site	Habitats Directive Annex I features: sandbanks, which area slightly covered by sea water all the time, estuaries, mudflats and sandflats not covered by seawater at low tide and Atlantic salt meadows *Glauco-Puccinellietalia maritimae* (Ramsar criterion 1). Unusual estuarine communities, reduced diversity and high productivity (Ramsar criterion 3). This Site is important for the run of migratory fish between sea and river via estuary. Species include salmon, sea trout (*Salmo trutta*), sea lamprey, river lamprey, allis shad, twaite shad and eel (*Anguilla anguilla*). The Site is important as a feeding and nursery ground for many fish species particularly allis shad and twaite shad which feed on mysid shrimps in the salt wedge (Ramsar criterion 8). It is also of particular importance for migratory birds during spring and autumn (Ramsar criterion 4) Assemblages of international importance: - Species with peak counts in winter (waterfowl) (Ramsar criterion 5).	1.5km south

Site Name	Features	Distance from Proposed Development
	- Species/populations occurring at levels of international importance (Ramsar criterion 6). Bewick's swan (*Cygnus bewickii*), greater white-fronted goose (*Anser albifrons albifrons*), common shelduck (*Tadorna tadorna*), gadwall (*Anas strepera*), dunlin (*Calidris alpine*), common redshank (*Tringa tetanus*). - Future species for consideration: During the breeding species: lesser black-backed gull (*Larus fuscus graelsii*) With peak counts in spring/autumn: ringed plover (*Charadrius hiaticula*) With peak counts in winter: teal (*Anas crecca*), northern pintail (*Anas acuta*).	
Severn Estuary SAC	Annex I habitats that are a primary reason for selection of this Site: Estuaries Mudflats and sandflats not covered by seawater at low tide Atlantic salt meadows (Glauco-Puccinellietalia maritimae) Annex I habitats present as a qualifying feature, but not a primary reason for selection of this Site: Sandbanks which are slightly covered by sea water all the time Reefs Annex II species that are a primary reason for selection of this Site: Sea lamprey, river lamprey and twaite shad	1.5km south
Severn Estuary Special Protection Area (SPA)	This Site qualifies under Article 4.1 of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive: Over winter: Bewick's swan. This Site qualifies under Article 4.2 of the Directive (79/409/EEC) by supporting populations of European importance of the following migratory species: On passage: ringed plover Over winter: curlew (*Numenius arquata*), dunlin, pintail, redshank, shelduck.	1.5km south

Site Name	Features	Distance from Proposed Development
	The area qualifies under Article 4.2 of the Directive (79/409/EEC) by regularly supporting at least 20,000 waterfowl, including gadwall, shelduck, pintail, dunlin, curlew, redshank, Bewick's swan, wigeon (*Anas Penelope*), lapwing (*Vanellus vanellus*), teal, mallard (*Anas platyrhynchos*), shoveler (*Anas clyptea*), pochard (*Aythya farina*), tufted duck, (*Aythya fuligula*), grey plover (*Pluvialis squatarola*), white-fronted goose and whimbrel (*Numenius phaeopus*).	
National Protected Sites		
River Usk SSSI	The River Usk (Lower Usk) (Abergavenny – Newport) is a rare example of a large mesotrophic lowland river which has not been subject to significant modification by man. Of particular significance to the river's morphology and biology are the extensive deposits of fluvio-glacial and alluvial material in the Usk valley between Abergavenny and Newport. The invertebrate fauna is characteristic of a large lowland river. Of special interest are the craneflies associated with silty river margins in the vicinity of Newbridge on Usk. The fish fauna is of international significance including several rare and scarce species and there is an expanding population of otters. Several scarce higher plant species occurring along the river's tidal reaches are also of special interest. Whilst not a special feature of the Site, there is a good range of breeding birds associated with riverine habitats. The SSSI incorporates adjacent areas of riparian habitat which directly support the special interest of the river. These include woodlands dominated by alder (*Alnus glutinosa*) and willows (*Salix spp*.), marshy grassland, stands of tall herb, swamp and fen vegetation, salt-marsh and coastal grassland.	Within Site boundary
Severn Estuary Site of Special Scientific Interest (SSSI)	The Severn Estuary lies on the south west coast of Britain at the mouth of four major rivers (the Severn, Wye, Usk and Avon) and many lesser rivers. The immense tidal range (the second highest in the world) and classic funnel shape make the Severn Estuary unique in Britain and very rare worldwide. The intertidal zone of mudflats, sand banks, rocky platforms and saltmarsh is one of the largest and most important in Britain. The estuarine fauna includes: internationally important populations of waterfowl; invertebrate populations of considerable interest; and large populations of migratory fish, including the nationally rare and endangered Allis shad. The SSSI forms the major part of a larger area of estuarine habitat, which includes the Upper Severn Estuary, the Taf/Ely Estuary and Bridgwater Bay.	1.5km south

Site Name	Features	Distance from Proposed Development
Newport Wetlands (National Nature Reserve (NNR)	The Site lies within the Gwent Levels and to the south of the city of Newport, adjacent to the Severn Estuary and close to the mouth of the River Usk In winter, Newport Wetlands support nationally (UK) important numbers of shoveler and black-tailed godwit (*Limosa limosa*). Other over -wintering species include gadwall, wigeon, shelduck, dunlin, redshank, whimbrel and curlew. During the summer Newport Wetlands supports an exceptional variety of breeding birds, including nationally (UK) important breeding populations of avocet (*Recurvirostra avosetta*), redshank, lapwing, water rail (*Rallus aquaticus*), Cetti's warbler (*Cettia cetti*) and bearded tit (*Panurus biarmicus*). In addition, breeding populations of ringed plover and little ringed plover (*Charadrius* dubius) also present. The aquatic invertebrate assemblage is diverse with nationally rare and scarce species are present, including the great silver water beetle (*Hydrophilus piceus*), the water beetle (*Hydaticus transversalis*) and the ornate brigadier soldierfly (*Odontomyia ornate*). The nationally scarce spider *Tetragnatha striata* has a strong population in the reedbeds and the nationally scarce shrill carder bee (*Bombus sylvarum*) is found throughout the Site. The watercourses are rich in plant species and communities, many of which are rare or absent in other levels systems. In the ditches themselves, submerged species such as curly pondweed (*Potamogeton crispus*), rigid hornwort (*Ceratophyllum demersum*) and, occasionally, stoneworts (*Chara spp.*) grow. Amongst the more notable species is hairlike pondweed which, in Wales, is almost entirely confined to the Gwent Levels area. There is a high diversity of floating plants, with all five British native duckweed species and frog-bit (*Hydrocharis morsus-ranae*) frequently abundant. Newport Wetlands is one of the few places on the Levels where nationally scarce least duckweed, is found at the north-western extent of its British range. Along the banks, fool's watercress (*Apium nodiflorum*), lesser water-parsnip (*Berula erecta*), tubular water dropwort (*Oenanthe fistulosa*) and water plantain (*Alisma plantago-aquatica*) occur. The reedbeds at Newport Wetlands are the largest within the south-east Wales area. In wetter areas with standing water, the vegetation is almost entirely composed of common reed (*Phragmites australis*). However, in drier areas, it is joined by marsh bedstraw (*Galium palustre*), hemp agrimony (*Eupatorium cannabinum*) and great willowherb (*Epilobium hirsutum*). In addition, the Site has a number of other habitats that add to its overall wildlife value. These include hedgerows, scrub, woodland and grassland.	1.5Km south
Gwent Levels – St. Brides SSSI	The information above (for the Gwent Levels – Rumney and Peterstone SSSI) is applicable here with regards to the	1.6km west

Site Name	Features	Distance from Proposed Development
	general ecology of the Gwent Levels SSSI. In addition, the following information is specific to the St Brides area: The reens in the St Brides area support a number of interesting plant species most notably thread-leaved water-crowfoot (*Ranunculus trichophyllus*) and small pondweed (*Potamogeton berchtoldii*). Reen bank and green lane habitats in this area are also important for relict meadow plant species such as the regionally notable grass vetchling (*Lathyrus nissolia*) and common meadow-rue (*Thalictrum flavum*). The St Brides area also supports rich invertebrate communities with a number of nationally notable and notable marshland species, e.g. the true fly (*Chrysogaster macquarti*) and the beetle (*Hydaticus transversalis*). It is the only area on the Gwent Levels where the rare fly *Stenomicra cogani* has been recorded.	
Gwent Levels-Nash and Goldcliff SSSI	The Gwent Levels constitute the lowlands between Cardiff and Chepstow and are drained by an ordered network of drainage ditches. The Gwent Levels reens are rich in plant species and communities, many of which are rare or absent in other Levels systems. The regular maintenance of some reens provides conditions for submerged species such as hairlike pondweed (*Potamogeton trichoides*) and openwater emergents such as arrowhead (*Sagittaria sagittifolia*) an opportunity to flourish. Nationally rare or notable aquatic invertebrate species are present such as *Haliplus mucronatus* and *Hydrophilus piceus*. The area is important in the Welsh context for its snails and dragonflies and includes the species *Physa heterostropha* and *Brachytron pratense* respectively. The large number of hedgerows add to the diversity of the area and together with the main reen banks provide a habitat for nationally important assemblages of terrestrial invertebrates such as *Pipunculus fonsecai* and *Tomosvaryella minima*. The Nash and Goldcliff area forms an important part of the Gwent Levels system and is of particular botanical interest as it is the only area in Wales for the least duckweed (*Wolffia arrhizal*). There is also an interesting community where two species of hornwort *Ceratophyllum submersum* and *C. demersum* grow together. The invertebrate interest is also high, as rare and notable species such as *Odontomyia ornata*, *Oplodontha viridula* and *Hydaticus transversalis* are present.	1.6km east

B2: Non-statutory designated Sites within 2km of the Site boundary.

Site Name	Reason for designation[34]	Approximate Distance from the Site
Marshall's SINC	Mosaic neutral grassland, post-industrial wetland along the banks of the River Usk.	Forms the embankment that is the Site
Solutia	A series of improved and semi-improved grasslands with traditional ditches and ponds, supporting a range of species including nesting birds such as Cetti's warbler and invertebrates including hairy dragonfly *Brachyton prantense.*	450- east of the Site
Alpha Steel	Area of former levels, scrub, and other habitat such as support a range of species including scarce moth species, birds such as Cetti's warbler, plants including orchids *Epicactis* palustris, *Ophrys apifera*, *Anacamptis pyramidalis, Dactylorhiza spp.*	520 east of the Site
Gwent Wetland Reserve	Mosaic of wet grassland, reed beds, open water, hedgerows and saline lagoon, which supports internationally important numbers of wildfowl as well as UKBAP priority species such as water vole, great crested newt and brown hare *Lepus europaeus*.	1.6 south of the Site
Afon Ebbw River	Major river system with associated semi-improved neutral and marsh grassland, swamp, scrub and semi-natural woodland with associated species including bulbous foxtail *Alopecurus* near the confluence with the River Usk, kingfisher *Alcedo atthis*, sandmartin *Riparia riparia* and grass snake *Natrix natrix*.	1.7 west of the Site.
Monkey Island	Mosaic post-industrial grassland, scrub and ruderal. Local record of blue pimpernel found on Site (the only record in Gwent)	1.2 north east of the Site
Julian's Gout Land	Neutral grasslands – maritime influence semi-improved neutral grassland with willow car and large populations of marsh helleborine *Epicactis palustris*, marsh orchids and narrow leaved bird's foot trefoil *Louts glaber.*	1.3 km south east of the site

B3: SEWBReC Desk Study Bird Records

Bird Species	Scientific Name	Status[35]
Black-tailed Godwit	*Limosa limosa*	Sch1
Cetti"s Warbler	*Cettia cetti*	Sch1, S7

[34] Newport City Council (2013) Sites of Importance for Nature Conservation (SINC) Background paper, Revised Deposit Plan – Newport Local Development Plan 2011 – 2026.

[35] Sch1 = Designated under Schedule 1 of the Wildlife and Countryside Act 1981 (as amended).
BDir1 = Birds listed on Annex I of the EC Birds Directive.
S7 = Birds listed on Section 7 of the Environment (Wales) Act 2016.

Bird Species	Scientific Name	Status[35]
Fieldfare	*Turdus pilaris*	Sch1
Goldeneye	*Bucephala clangular*	Sch1
Green Sandpiper	*Tringa ochropus*	Sch1
Greenshank	*Tringa nebularia*	Sch1, S7
Little Ringed Plover	*Charadrius dubius*	Sch1
Peregrine	*Falco peregrinus*	Sch1, BDir1, S7
Redwing	*Turdus iliacus*	Sch1, S7
Ruff	*Philomachus pugnax*	Sch1, BDir1, S7
Aquatic Warbler	*Acrocephalus paludicola*	S7, BDir1
Bar-tailed Godwit	*Limosa lapponica*	BDir1
Bittern	*Botaurus stellaris*	Sch1, BDir1, S7
Black-headed Gull	*Chroicocephalus ridibundus*	S7
Bullfinch	*Pyrrhula pyrrhula*	S7
Common Scooter	*Numenius arquata*	S7
Corn Bunting	*Emberiza calandra*	S7
Corncrake	*Crex crex*	Sch1, BDir1, S7
Cuckoo	*Cuculus canorus*	S7
Curlew	*Numenius arquata*	S7
Dunnock	*Prunella modularis*	S7
Golden Plover	*Pluvialis apricaria*	BDir1, S7
Grasshopper Warbler	*Locustella naevia*	S7
Hen Harrier	*Circus cyaneus*	Sch1, BDir1, S7
Herring Gull	*Larus argentatus*	S7
House Sparrow	*Passer domesticus*	S7
Kestrel	*Faclo tinnunculus*	Sch1, S7
Lapwing	*Vanellus vanellus*	S7

Bird Species	Scientific Name	Status[35]
Lesser Redpoll	*Carduelis cabaret*	S7
Linnet	*Carduelis cannabina*	S7
Pied Flycatcher	*Ficedula hypoleuca*	S7
Reed Bunting	*Emberiza schoeniclus*	S7
Ring Ouzel	*Turdus torquatus*	S7
Ringed Plover	*Chairadrius hiaticula*	S7
Skylark	*Alauda arvensis*	S7
Song Thrush	*Turdus philomelos*	S7
Spotted Flycatcher	*Muscicapa striata*	S7
Starling	*Sturnus vulgaris*	S7
Tree Pipit	*Anthus trivialis*	S7
Tree Sparrow	*Passer montanus*	S7
Willow Tit	*Poecile montanus*	
Wood Warbler	*Phylloscopus sibilatrix*	S7
Woodlark	*Lullula arborea*	Sch1, BDir1, S7
Yellow Wagtail	*Motacilla flava*	S7
Yellowhammer	*Emberiza citrinella*	S7

Appendix C

C1: Reptile Survey Results and Weather Conditions

Survey Date	Weather	Survey Results
17.04.18 – Set up	13 °C, wind speed 2, northerly direction, 100% cloud cover, dry.	No reptiles
08.05.18	13°C, wind speed 2, southerly direction, cloud cover 70%, dry	No reptiles
10.05.18	14°C, light wind speed 2, SW direction, 70 % cloud, sunny.	No reptiles
15.05.18	17°C, wind speed 1, southerly direction, 5% cloud cover, sunny.	No reptiles
17.05.18	17 °C, wind speed 2, southerly direction, 40% cloud cover, sunny.	No reptiles
22.05.18	10 °C, wind speed 3, easterly 50 % cloud cover, sunny	No reptiles
24.05.18	13°C, windspeed 1, southerly, 100 % cloud cover, light drizzle.	No reptiles
19.07.18 survey and collect	19°C, windspeed 1, southerly, 10 % cloud cover, sunny.	No reptiles

C2: Great Crested Newt eDNA results.

DNA Analysis Report - Commercial in Confidence

Customer:	Ove Arup & Partners International Ltd
Address:	4 Pierhead Street Cardiff CF10 4QP
Contact:	Claire Pooley
Email:	claire.pooley@arup.com
Tel:	07769256169
Report date:	22-May-2018
Order Number:	GCN18-0758
Samples:	Pond Water
Analysis requested:	Detection of Great Crested Newt eDNA from pond water.

Thank you for submitting your samples for analysis with the Fera eDNA testing service. The details of the analysis are as follows:

Method:
The method detects pond occupancy from great crested newts (GCN) using traces of DNA shed into the pond environment (eDNA). The detection of GCN eDNA is carried out using real time PCR to amplify part of the cytochrome 1 gene found in mitochondrial DNA. The method followed is detailed in Biggs J., et al, (2014). Analytical and methodological development for improved surveillance of the Great Crested Newt. Appendix 5. Technical advice note for field and laboratory sampling of great crested newt (Triturus cristatus) environmental DNA. Freshwater Habitats Trust, Oxford.

The limits of this method are as follows: 1) the results are based on analyses of the samples supplied by the client and as received by the laboratory, 2) any variation between the characteristics of this sample and a batch will depend on the sampling procedure used. 3) the method is qualitative and therefore the levels given in the score are for information only, they do not constitute the quantification of GCN DNA against a calibration curve, 4) a 'not detected' result does not exclude presence at levels below the limit of detection.

The results are defined as follows:

Positive:	DNA from the species was detected.
eDNA Score:	Number of positive replicates from a series of twelve.
Negative:	DNA from the species was not detected; in the case of negative samples the DNA extract is further tested for PCR inhibitors and degradation of the sample.
Inconclusive:	Controls indicate degradation or inhibition of the sample, therefore the lack of detection of GCN DNA is not conclusive evidence for determining the absence of the species in the sample provided.

DNA Analysis Report - Commercial in Confidence

CustomerReference	Fera Reference	GCN Detection	eDNA Score	Inhibition	Degradation
-	S18-015371	Positive	1	n/a	n/a

The results indicate that eDNA for great crested newts was detected in the sample submitted. Analysis was conducted in the presence of the following controls: 1) extraction blank, 2) appropriate positive and negative PCR controls for each of the TaqMan assays (GCN, Inhibition, and Degradation). All controls performed as expected.

This test procedure was developed using research funded by the Department of Environment, Food and Rural Affairs.

Issuing officer: Steven Bryce
Tel: 01904 462 070
Email: e-dna@fera.co.uk

DNA Analysis Report - Commercial in Confidence

Customer:	Ove Arup & Partners International Ltd
Address:	4 Pierhead Street Cardiff CF10 4QP
Contact:	Claire Pooley
Email:	claire.pooley@arup.com
Tel:	07769256169
Report date:	02-May-2018
Order Number:	GCN18-0758
Samples:	Pond Water
Analysis requested:	Detection of Great Crested Newt eDNA from pond water.

Thank you for submitting your samples for analysis with the Fera eDNA testing service. The details of the analysis are as follows:

Method:

The method detects pond occupancy from great crested newts (GCN) using traces of DNA shed into the pond environment (eDNA). The detection of GCN eDNA is carried out using real time PCR to amplify part of the cytochrome 1 gene found in mitochondrial DNA. The method followed is detailed in Biggs J., et al, (2014). Analytical and methodological development for improved surveillance of the Great Crested Newt. Appendix 5. Technical advice note for field and laboratory sampling of great crested newt (Triturus cristatus) environmental DNA. Freshwater Habitats Trust, Oxford.

The limits of this method are as follows: 1) the results are based on analyses of the samples supplied by the client and as received by the laboratory, 2) any variation between the characteristics of this sample and a batch will depend on the sampling procedure used. 3) the method is qualitative and therefore the levels given in the score are for information only, they do not constitute the quantification of GCN DNA against a calibration curve, 4) a 'not detected' result does not exclude presence at levels below the limit of detection.

The results are defined as follows:

Positive:	DNA from the species was detected.
eDNA Score:	Number of positive replicates from a series of twelve.
Negative:	DNA from the species was not detected; in the case of negative samples the DNA extract is further tested for PCR inhibitors and degradation of the sample.
Inconclusive:	Controls indicate degradation or inhibition of the sample, therefore the lack of detection of GCN DNA is not conclusive evidence for determining the absence of the species in the sample provided.

DNA Analysis Report - Commercial in Confidence

CustomerReference	Fera Reference	GCN Detection	eDNA Score	Inhibition	Degradation
-	S18-003476	Negative	0	No	No
-	S18-003477	Negative	0	No	No
-	S18-003478	Negative	0	No	No
-	S18-003479	Negative	0	No	No
-	S18-003481	Negative	0	No	No

The results indicate that eDNA for great crested newts was not detected in any of the samples submitted. Analysis was conducted in the presence of the following controls: 1) extraction blank, 2) appropriate positive and negative PCR controls for each of the TaqMan assays (GCN, Inhibition, and Degradation). All controls performed as expected.

This test procedure was developed using research funded by the Department of Environment, Food and Rural Affairs.

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Annexe A: Botanical Survey Report

Ove Arup and Partners

Stephenson Street Embankment, Newport

Vegetation survey

September 2018

Sturgess Ecology

Contents

Document reference: C245/D1/V1

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

This document has been produced for Ove Arup and Partners by:

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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.

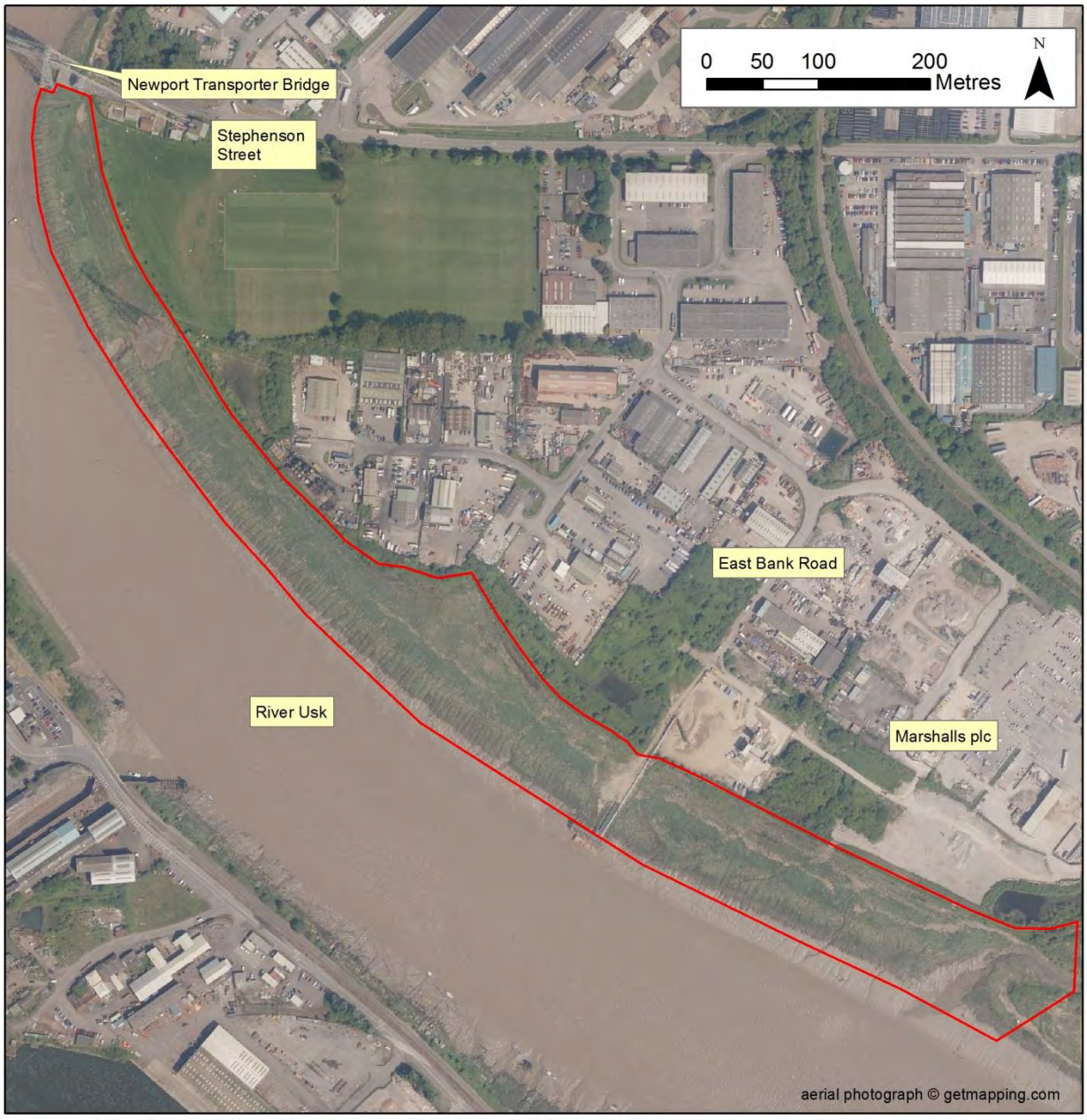

Figure 1. Overview of study area

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.

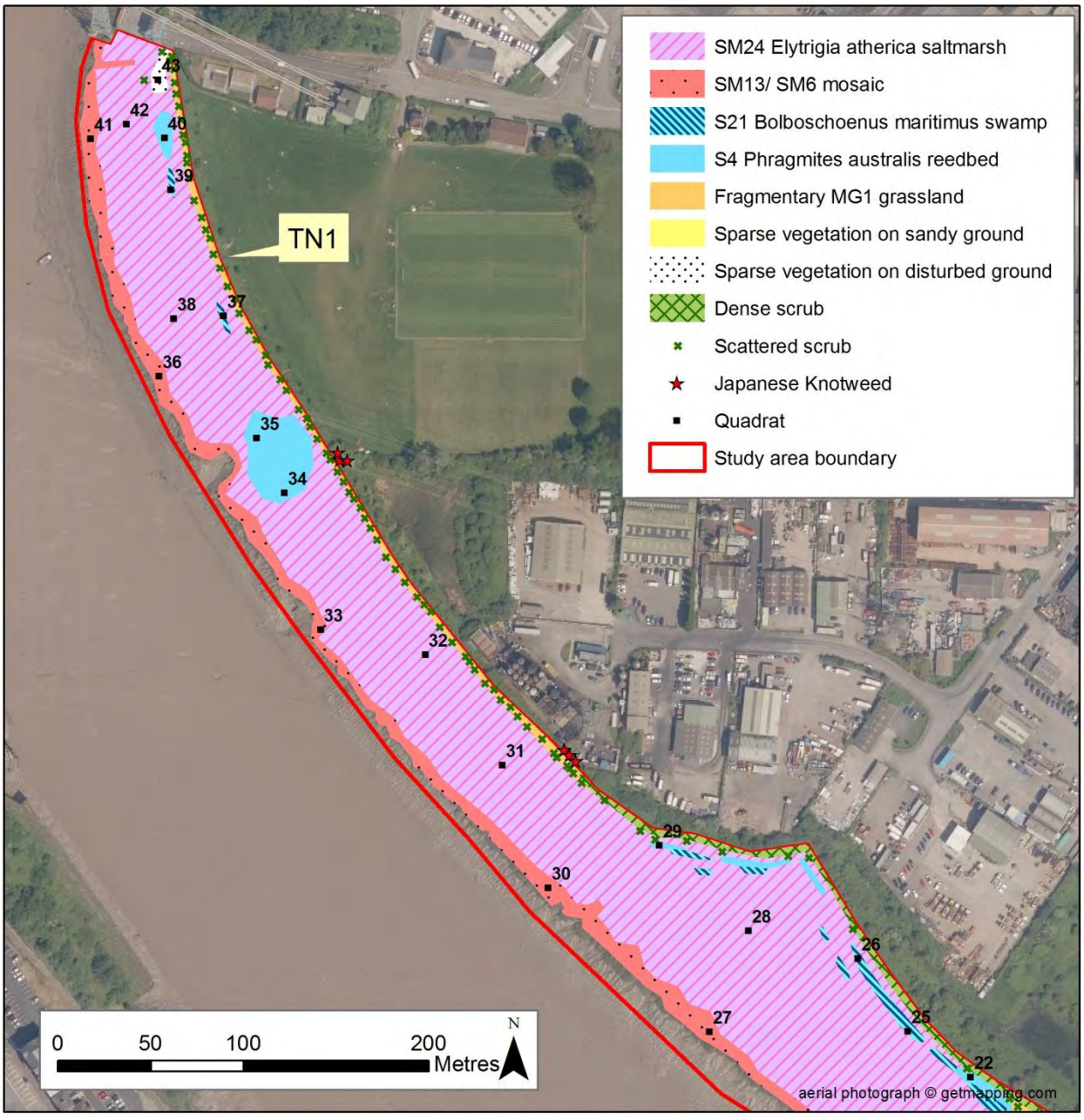

Figure 2a. Vegetation plan, northern part.

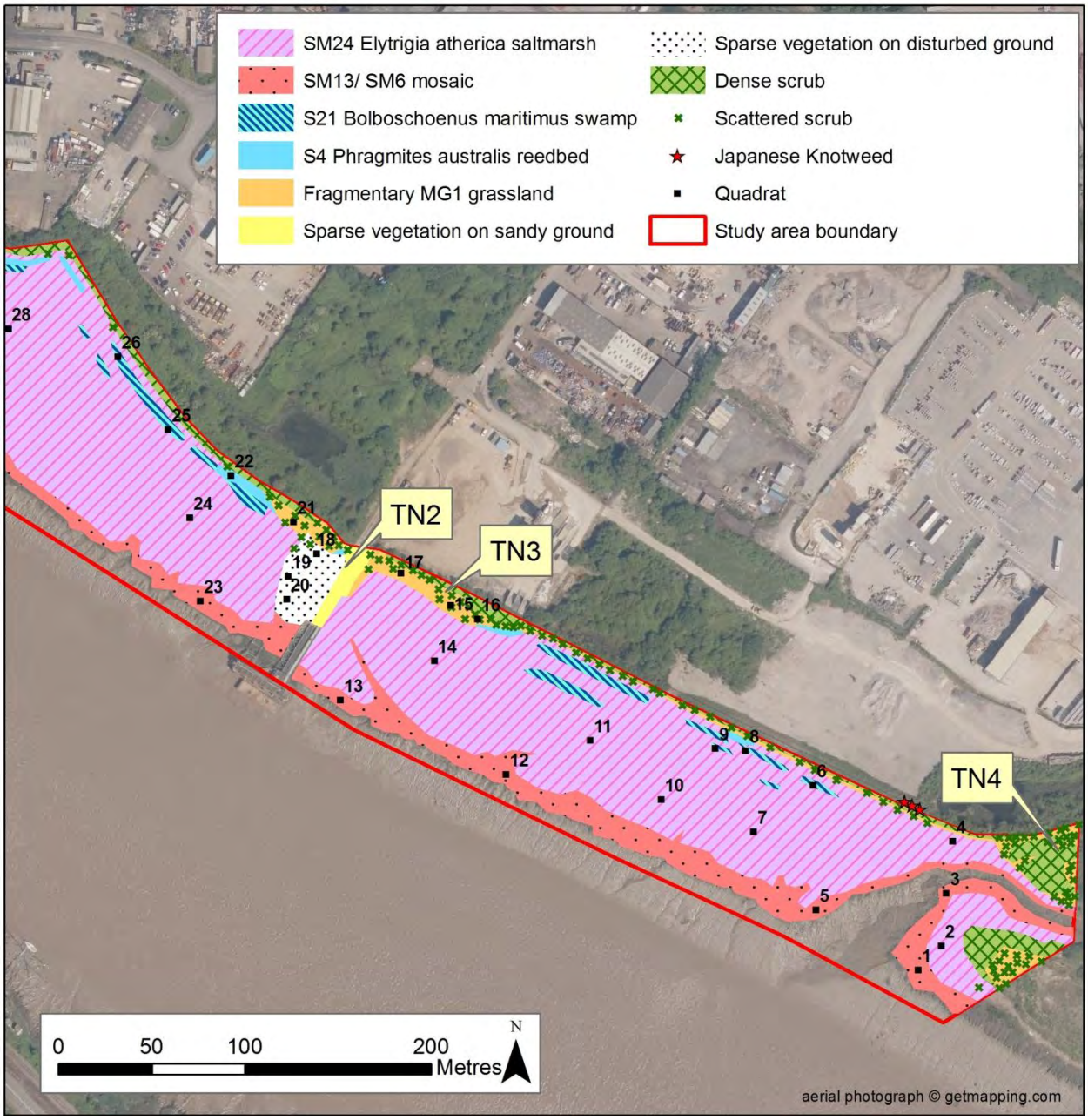

Figure 2b. Vegetation plan, southern part.

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
Elytrigia atherica	10	10	10	10	10	10	10	10	10	10	10	V
Atriplex prostrata	2		1		A		1				A	I
Althaea officinalis		1										I
Beta vulgaris		A										
Lepidium latifolium		A										
Phragmites australis								A				
Rubus fruticosus		A										
Sonchus arvensis				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
Aster tripolium	8	5	5	4	4	7	1	8	5	6	4	6	V
Puccinellia maritima	6	4	5	10	4	10	6	8	9	9	9	8	V
Suaeda maritima	5	1	A	1	2	2	2	1	4	3	1	A	V
Atriplex prostrata	2	4			A	1	7	2	2	5	A		III
Elytrigia atherica		2	A			A	A	1	2	4	A	4	III
Spartina anglica	2	6	8	2	10	A		A	1	A	4		III
Cochlearia anglica									1				I
Glaux maritima		5											I
Triglochin maritimum		4											I
Beta vulgaris					A								
Plantago maritima									A				
Spergularia media		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
Bolboschoenus maritimus	8	3		10	1	9	8	V
Elytrigia atherica	A	4	5	1	5	8	8	V
Atriplex prostrata		1	1	2	5		2	IV
Glaux maritima	4	4			4			III
Juncus gerardii		2	7		5		4	III
Festuca rubra	1	4						II
Lepidium latifolium	2	A			1			II
Triglochin maritimum	A	2	4					II
Aster tripolium		A	2					I
Beta vulgaris						1	A	I
Carex extensa					1			I
Oenanthe crocata					1			I
Phragmites australis		2						I
Ranunculus sceleratus		1						I
Sonchus oleraceus					1			I
Spergularia marina	2							I
Suaeda maritima			1					I
Tripleurospermum inodorum	1							I
Carex otrubae	A	A						
Chenopodium rubrum	A							
Plantago coronopus	A							
Sonchus arvensis	A						A	
Sonchus asper						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

Quadrat	22	29	34	35	40	Frequency
Species						
Phragmites australis	10	10	10	10	10	V
Atriplex prostrata	A	1			2	II
Elytrigia atherica	1	2				II
Rubus fruticosus		A				0
Buddleja davidii		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
Anagallis arvensis	3	1	4		IV
Tripleurospermum inodorum	4	3	2	A	IV
Agrostis stolonifera	A	2		4	III
Conyza floribunda	1	3			III
Hirschfeldia incana	1	3			III
Holcus lanatus	1	1			III
Hypericum perforatum	2	1			III
Pastinaca sativa	1	1			III
Potentilla anserina	1	A	6		III
Aster tripolium				1	II
Atriplex prostrata			A	1	II
Bellis perennis	1				II
Cirsium arvense		1		A	II
Elytrigia atherica				1	II
Oenothera cf biennis	1				II
Ononis repens	A	6			II
Plantago coronopus	1	A			II
Plantago major	2				II
Polygonum aviculare				2	II
Potentilla reptans	A	2			II
Ranunculus repens	1	A			II
Rubus fruticosus	1	A			II
Rumex crispus		1			II
Sonchus arvensis			1		II
Spergularia marina				3	II
Taraxacum sp.	1				II
Tripleurospermum maritimum			4		II
Beta vulgaris				A	
Carex otrubae				A	
Daucus carota				A	
Epilobium parviflorum	A				
Juncus inflexus	A				
Lycopus europaeus	A				
Persicaria amphibia				A	
Phalaris canariensis			A		
Picris echioides			A		
Senecio vulgaris			A		
Sonchus asper				A	
Sonchus oleraceus			A		
Verbena officinalis	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:

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

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
Arrhenatherum elatius	4	8	5	6	V
Festuca rubra	5	3	5	2	V
Rubus fruticosus	5	2	2	4	V
Cirsium arvense		2	1	1	IV
Elytrigia atherica	4	3	5	A	IV
Medicago lupulina	2		3	2	IV
Pastinaca sativa	1	1	A	4	IV
Senecio erucifolius	A	2	1	2	IV
Torilis japonica	1	2	2		IV
Agrostis stolonifera			5	6	III
Conyza floribunda	A		2	2	III
Dactylis glomerata			2	2	III
Dipsacus fullonum	1	A	1	A	III
Hypericum perforatum	2			2	III
Picris echioides		2	2		III
Sison amomum		1	2		III
Carex hirta				2	II
Carex otrubae			2		II
Centaurium erythraea			2		II
Cerastium fontanum				1	II
Clematis vitalba	4				II
Crataegus monogyna	1	A	A		II
Galium mollugo	4				II
Hedera helix	6				II
Holcus lanatus				4	II
Homalothecium lutescens				1	II
Lepidium draba			1		II
Leucanthemum vulgare	5				II
Ophrys apifera	1				II
Poa trivialis	2				II
Prunella vulgaris				2	II
Rosa canina	A	1	A	A	II
Rumex crispus		2			II
Solanum dulcamara			1		II
Sonchus arvensis		1			II
Thuidium tamariscinum	4				II
Tripleurospermum inodorum			1		II
Vicia cracca		1			II
Alnus glutinosa				A	
Atriplex prostrata		A			
Buddleja davidii	A				
Centaurea nigra	A				
Epilobium hirsutum		A			
Epilobium parviflorum					
Eupatorium cannabinum	A	A			
Juncus inflexus				A	
Lycopus europaeus		A			
Melilotus altissimus				A	
Myosotis arvensis	A			A	
Prunus spinosa			A		
Veronica chamaedrys	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:

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

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

Rodwell, J.S. (ed.), C.D. Pigott, D.A. Ratcliffe, A.J.C. Malloch, H.J.B. Birks, M.C.F. Proctor, D.W. Shimwell, J.P. Huntley, E. Radford, M.J. Wiggington, P. Wilkins, (1991 - 2000). British Plant Communities. Volumes 1-5. Cambridge University Press, Cambridge.

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

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

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

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

Appendix 2. Incidental fauna observations

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