

RSPB Higham Marshes Habitat Enhancement Project



Water Vole (Rob Budgen, 2016)

Design and Access Statement
Planning Application Proposal Supporting Documentation
Author: Will Tofts

Contents

1. Introduction	3
1.1. RSPB Higham Marshes	3
1.2 RSPB Vision	5
1.3 Overarching objectives	6
1.4 Overarching outcomes	6
2. Site Assessment	7
2.1 Historic Use	7
2.2 Landscape Character	7
2.4 Designation and Legal Protection	8
2.5 Statutory SSSI site condition assessment	8
2.6 RSPB site condition assessment	9
2.6.2 Targets within context	11
2.7 social and economic context (including access).	12
2.8 Planning policy	13
2.9 Consolation	13
3. Design Process	13
3.1 Baseline data	13
3.1.1 Biological	13
3.1.2. Non-Biological	14
3.2 Evaluation and design considerations	14
3.2.1. Habitat(s)	14
3.2.2. Species and/or assemblages	14
3.2.3. Hydrology (incorporating neighbouring land use)	15
3.2.4. Soils	16
3.2.5. Topography	16
3.2.6. Archaeology and Unexploded Ordnance	17
3.2.7. Built infrastructure	18
4.Design elements	18
4.1 Hydrological controls	18
4.2 Habitat enhancements	18
4. Design	20
Appendix 1	22

1. Introduction

1.1. RSPB Higham Marshes

Freshwater wetland habitats in the UK are fragile ecosystems totally reliant on the correct hydrology and are at risk from various threats including, but not exhaustively, the following:

- Development
- Intensive drainage for agriculture and flood defence purposes
- Climate change including:
 - o Sea-level rise leading to saltwater incursion where not defended by seawalls and associated infrastructure
 - o Changes in precipitation patterns. Whilst there are various scenarios, winters are generally predicted to be wetter and the spring and summer seasons are generally expected to be drier

The biodiversity of many areas that were, or even are, considered prime wetland habitats have already been denuded due to inappropriate hydrology. The climate change predictions for precipitation, particularly in southeast England where the effects will be most acutely experienced, paint a bleak picture.

As such, potential areas with conditions suitable to support the creation, or recreation, of prime wetland habitat within the region are limited, so any opportunity to do so is treated as a key priority for the Royal Society for the Protection of Birds (RSPB).

The Greater Thames estuary and marshes, also an RSPB Futurescape, is a large coastal wetland and a vital migration hub for hundreds of thousands of wildfowl and wading birds.

This project will deliver landscape-scale habitat restoration and innovative solutions for climate resilience in the Greater Thames Estuary. The RSPB working with partner organisations; Kent Wildlife Trust, Essex Wildlife Trust, Kent Wildfowling & Conservation Association and Elmley Nature Reserve Community Interest Company will restore and enhance 1,805 ha across 24 important Coastal and Floodplain Grazing Marsh (C&FGM) sites. This project seeks to make better use of freshwater across the landscape implementing 29 innovative smart solar pumps at 14 of the project sites, while also improving habitat

Across all 24 sites habitat conditions are failing to meet the needs of waders & other priority species. This project will work to address the below key issues facing the project sites:

- o Surface pools dry out, depriving wader chicks of food and habitat for other species. Existing hydrological systems are inefficient and do not provide the volume of water required to maintain wet features throughout the spring and summer, this is getting worse through climate change;

- o The lack of infrastructure to support grazing regimes which create the optimal grass sward structure that breeding waders need;
- o Lack of nesting habitat for waders;

Higham Marshes is a 177.2 hectare area of predominantly, grassland, bisected (North to South) by an area of common land, and Environment Agency Main river (East to West). The northern boundary comprises the Thames and its associated flood defences and to the south the Village of Higham and agricultural land.

The land is used for the conservation of various species of conservation concern, with active habitat management carried out by the RSPB to ensure the habitats are in the right and best condition for them to thrive. The RSPB entered into a management agreement with the Landowner in 2013. Work was carried out to isolate the site from the surrounding drainage system in 2014. Various other small-scale habitat improvement works have been carried out in the following years. In 2019 the RSPB purchased the land from the landowner, excluding Higham Common.

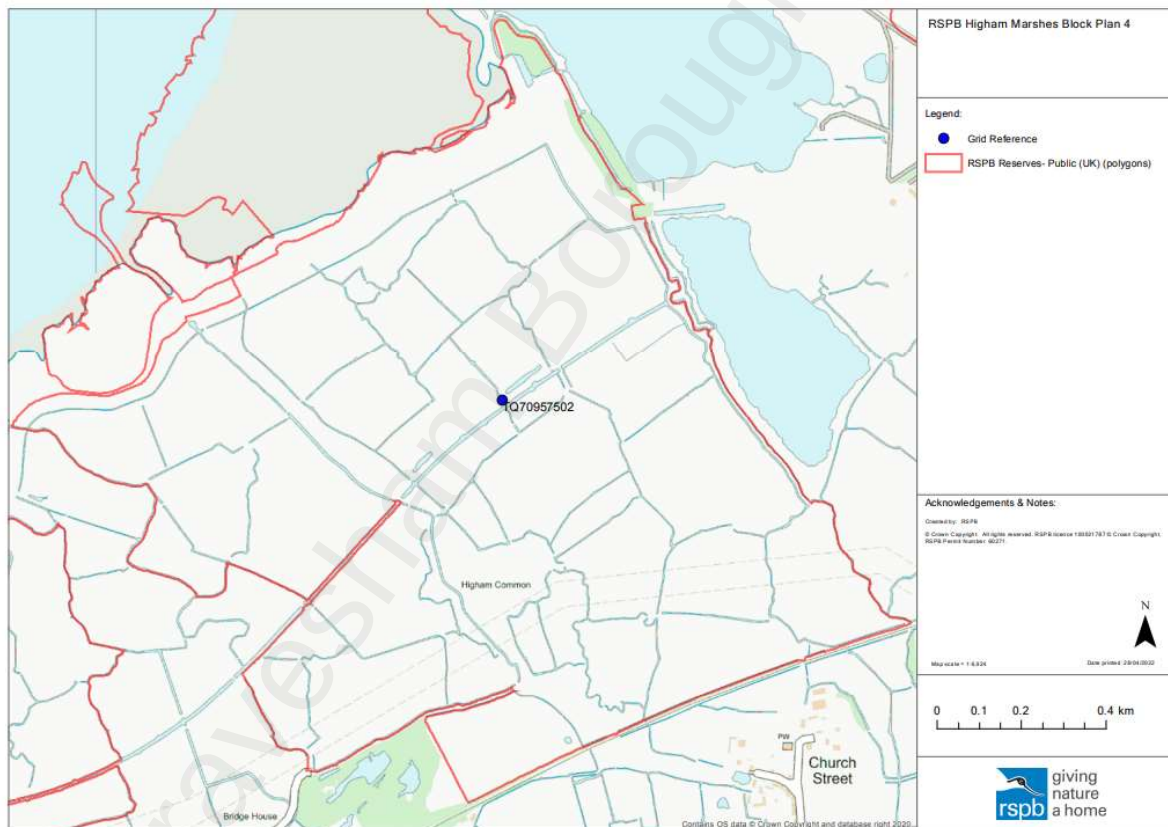


Figure 1: Higham Marshes Location

The vast majority of the Seasalter Levels Partnership Project Area is designated as part of:

1. **The Thames Estuary and Marshes Special Protection Area (SPA)**
 The citation is presented in the document '*Higham_Marshes_Thames_Estuary_and_Marshes_SPA Citation*'.

2. **The Thames Estuary and Marshes Ramsar site**
The citation is presented in the document '*Higham_Marshes_Thames_Estuary_and_Marshes_Ramsar Citation*'.
3. **The South Thames Estuary and Marshes Site of Special Scientific Interest (SSSI)**
The citation is presented in the document '*Higham_Marshes_South_Thames_Estuary_and_Marshes SSSI Citation*'.

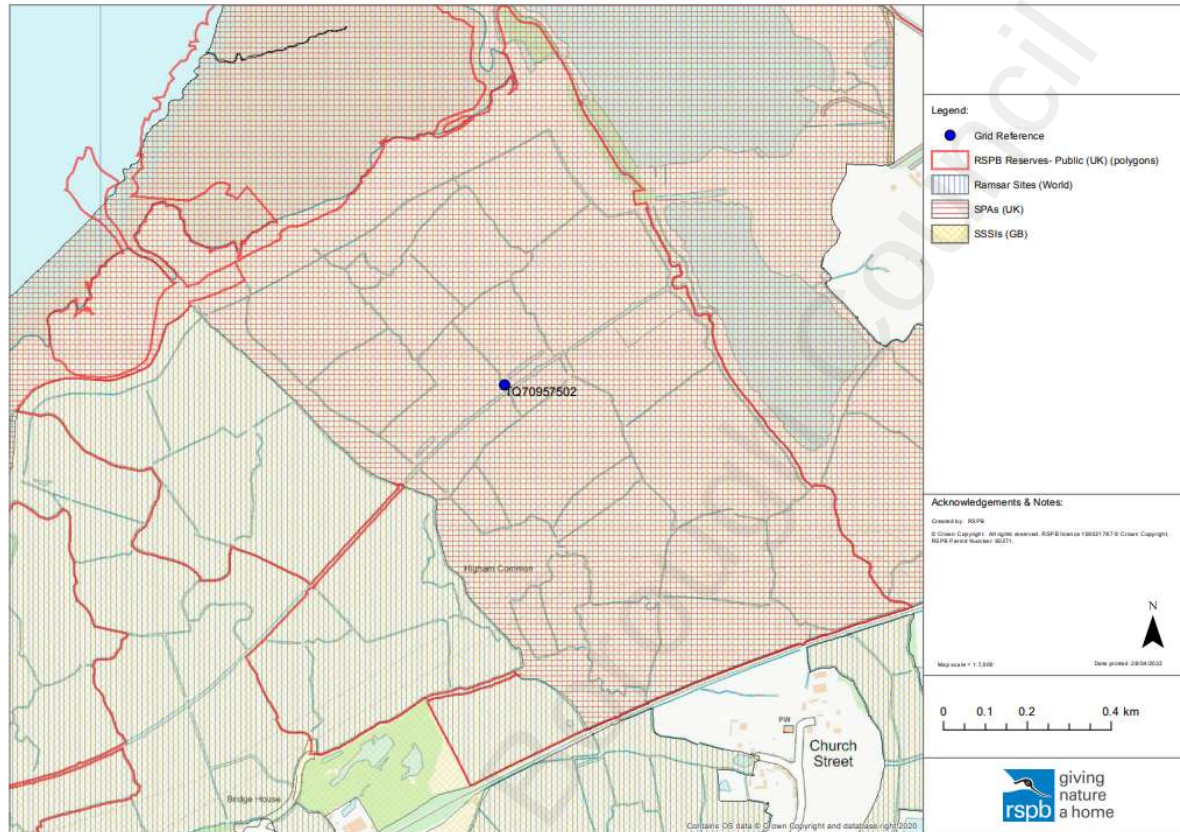


Figure 2: RSPB Higham Marshes Designations

The boundaries of the designated areas in relation to the site are shown in Figure 2.

This proposal is the beginning of wholly realising vision of a vibrant and fully functioning wetland reserve that links to the Lawton Principles on the Hoo Peninsula and Greater Thames of Bigger, Better and more Joined up and also making the site worthy of the designations that protect it.

1.2 RSPB Vision

The RSPB produces management plans on a 5-year cycle for each of its nature reserves. These documents set out the management and monitoring regimes for that period and, where the site is designated, are subsequently consented by Natural England to provide the authorisation to undertake the operations specified therein. Each management plan also has a vision presenting the aspirations for the reserve in 25 years' time. The following is the vision from the Higham Marshes management plan 2019-2024:

Over the next 25 years, Higham Marshes will remain one of the prime breeding wader sites in North Kent. We will have completed the final improvements to the lowland wet grassland during the life of this plan to ensure that every part of the site, and the subtle variations within the habitat, is as

productive as it possibly can be for the species that are reliant on lowland wet grassland in this part of the UK.

The management set out in this plan will have remained as the way to manage Higham and it will be consistently delivering a vibrant wetland habitat where important populations of key species of conservation concern flourish. The management will have remained dynamic and appropriate to the seasons for both resident species and migratory species at the relevant times of the year that profit from Higham Marshes as a home.

Spring will be alive with the sound of up to 65 pairs of peewitting lapwing and over 75 pairs of chipping redshank. These ambitious numbers for the site will be, in no small part, due to the resurgence of these species' populations in the wider countryside. Water voles will continue to thrive in every ditch, European eel will have recovered and be part of a flourishing aquatic environment whilst a variety of birdsong will be heard each spring across the site and around the periphery in particular.

Summer will be a time for important invertebrates with scarce emerald damselfly continuing to be spotted floating around ephemeral pools associated with sea-club rush and divided sedge whilst new 'emeralds' such as southern and willow will be a part of the assemblage having continued to colonise the UK. Working closely with core partners, our four rare carder-bee species, particularly shrill and brown-banded carder-bees, will be thriving along the seawall and other parts of the site as they seek out the nectar from the flowers that we will have ensured are present in sufficient quantities to support these long-tongued bees.

During winter, the shallow flooding that will be maintained as part of the management cycle will provide vital feeding and roosting habitat and entice thousands of wintering waders and wildfowl to utilise the site allowing it to be a highly effective part of the habitat required by the vast assemblage of waterfowl that congregates in the Thames Estuary every year.

Most importantly, Higham Marshes will have continued to remain as a wonderful example of how agricultural productivity can be achieved whilst sustaining an exceptional home for wildlife in all of its myriad forms.

Whilst the vision experiences minor updates when a new management plan is produced to reflect the situation at the time of writing, the overarching objectives and outcomes have remained consistent since our involvement with Higham Marshes began in 2013 - and will do so into the future.

1.3 Overarching objectives

1. To enhance Higham Marshes SSSI units Favourable condition where applicable and, concurrently, to become high quality examples of these habitats. This will include delivering appropriate long-term management solutions i.e. grazing, as well as introducing new hydrological controls by undertaking groundworks and the installation of appropriate infrastructure to achieve the objective.

1.4 Overarching outcomes

- To support biodiversity and habitats of regional and national importance, the hydrology of Higham will be modified to produce optimal hydrological management for breeding waders such as lapwing and redshank, wintering wildfowl such as teal and wigeon and passerines such as skylark and grasshopper warbler. The headline species list will also include non-avian species such as water vole, European eel, rare bumblebees where applicable
- Where not already in place, suitable grassland, reedbed, scrub and ditch management will be introduced to produce optimal grazing marsh habitat for target species:

- o Grassland, scrub and reedbed management will be provided by targeted grazing and mechanical management regimes. This will include sourcing and installing suitable graziers as required
- o Ditch management will be provided by the sympathetic restoration of the ditch network initially as required and/or the creation of a rotational management regime.

Defined by the UK Government's Green Recovery Challenge Fund (GRCF) administered by the National Lottery Heritage Fund (NLHF) the proposal will be delivered in one phase during the second half of 2022 to comply with the GRCF's deadline for project completion by 31st March 2023. This proposal seeks to address the need for improvement of suitable grazing, hydrology and topographical features, across Higham Marshes.

2. Site Assessment

2.1 Historic Use

2.2 Landscape Character

Higham Marshes sits to the east of a large industrial operation of aggregates, to the west, RSPB Shorne Marshes to the west, the Thames river to the north and Higham Village and surrounding agriculture to the south, mostly arable of fruits and crops.

Gravesham Council describes the landscape as:

The following key characteristics are identified for this area, all of which are relevant to the parcels defined adjacent to Gravesend:

Flat grazing marsh with a lack of vegetation

- *Sense of remoteness with extensive views across marshes*
- *Network of ditches and meandering waterways divide the marshes in an irregular pattern leaving parcels of land of a medium scale*
- *No roads and limited development*
- *Features of historic interest including Shornemead Fort*
- *Extensive views across the River Thames and to higher ground to the south.*

The condition of the landscape of the Shorne and Higham Marshes character area is assessed as good, with sensitivity assessed as high. This is due to the intact landscape with few visual detractors and strong ecological integrity, and the simple open landscape with traditional field patterns and lack of settlement.

*The guidelines for this character area state that planning should 'restrict development proposals that encroach onto the marsh from the urban fringe surrounds, seeking opportunities to improve the appearance of the urban edge.'*¹

¹file:///C:/Users/willtofts/Downloads/Gravesham%20Landscape%20Sensitivity%20and%20Capacity%20Studyw.pdf

2.4 Designation and Legal Protection

As previously noted, Higham Marshes is highly protected, and it is expected that the enhancement works will not only complement the designations but enhance the condition of this part of the designated sites, the habitats therein and the species noted in the citations. Furthermore, it is expected that the enhancement works will provide significantly improved habitat conditions for a raft of fauna and flora of conservation concern not cited in the designations, including some with their own legal protection, that are present, or could be, at Higham Marshes.

Impacts experienced during the creation of the habitat enhancements on the designated sites, the habitats and the fauna and flora as well as the long-term impacts after the habitats have been enhanced, both negative and positive, are discussed in detail in the documents:

- 'Higham_Marshes Report to Inform an Assessment Under the Habitats Regulations'. For European sites
- 'Higham Marshes Ecological Site Assessment'. For residual sites/features of conservation concern not part of the European sites' appraisal

In addition, Higham Marshes holds numerous archaeological features that are headlined by the various salterns of which some have extra protection as Scheduled Ancient Monuments. It is RSPB's standard operating procedure to preserve all archaeological features irrespective of their level of protection i.e. this will include features that have not been identified on the Kent Historic Environment Register.

2.5 Statutory SSSI site condition assessment

Whilst assessments of the current condition of The Thames Estuary and Marshes SPA and The Thames Estuary and Marshes Ramsar sites are not directly available, the SSSI site condition assessments fulfil the function practically for all three designations. The following summarises the SSSI site condition assessments for the SSSI units where the enhancements are proposed:

Higham Marshes – within application scope

South Thames Estuary & Marshes

Unit 27 (majority) - Favourable 12/02/2009

Unit 28 - Favourable 12/02/2009

Unit 29 - Favourable 12/02/2009

Unit 48- Favourable 12/02/2009

Unit 49 - Favourable 12/02/2009

Higham Marshes – Outside of application scope

100 (part) - Unfavourable declining 19/03/2009

- Areas of saltmarsh scattered along the coast between the mudflats and the sea wall, hence the Unfavourable declining condition due to coastal squeeze

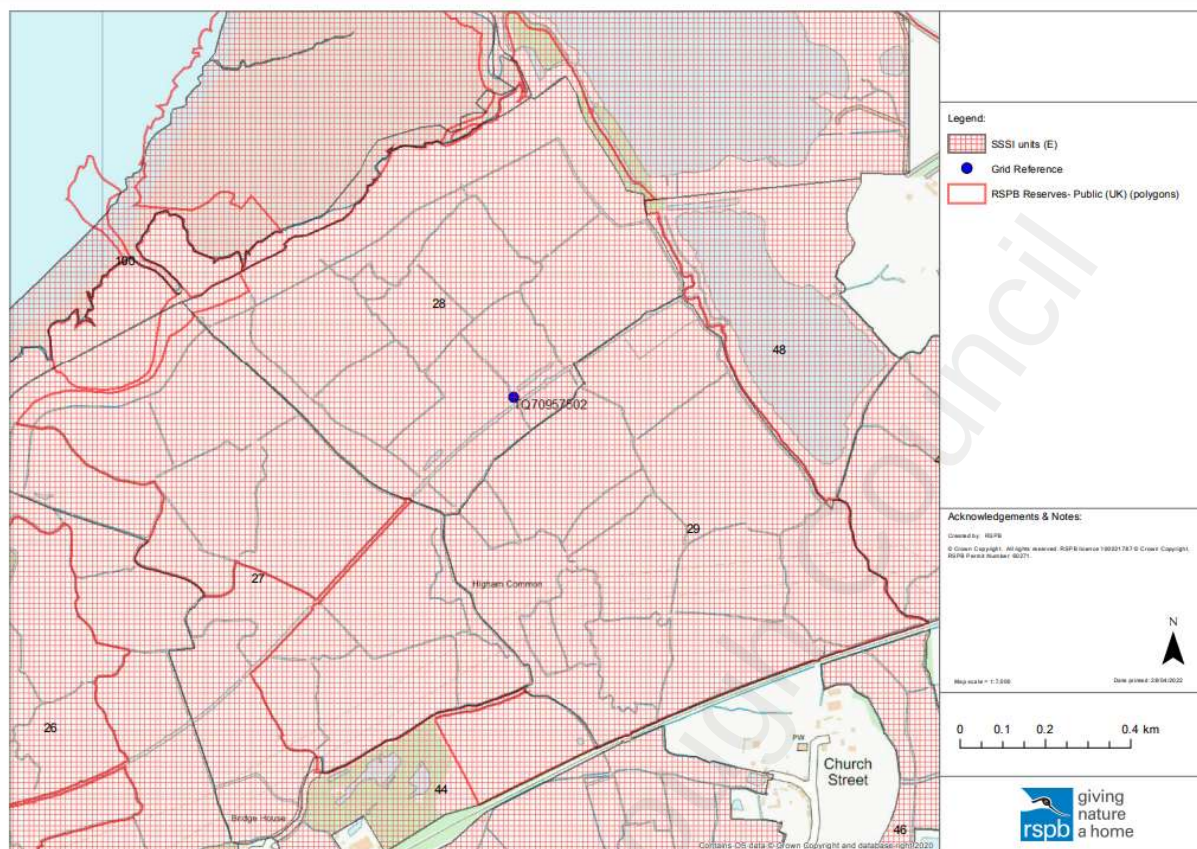


Figure 3: The South Thames Estuary and Marshes SSSI Units on Higham Marshes.

2.6 RSPB site condition assessment

RSPB assessment of the habitats coincides entirely with the SSSI condition assessments of Higham Marshes. However, whilst we agree the site is Favourable, we do not assess them to be as Favourable as they could/should be, hence the desire to undertake the habitat enhancements.

2.6.1 Management plan objectives

Each RSPB management plan has detailed objectives and targets. The current Higham Marshes management plan (2019-2024) has four distinct objectives based on broad habitat types with numerous targets for species and habitat conditions. Objective 1 covers the grassland habitat across the application area and is shown below with a compartment map for reference presented at Figure 4. This area is the subject to this planning application sit within this objective.

1. To maintain favourable SSSI condition across the 160ha of lowland wet grassland at Higham Marshes and maintain or increase populations of RSPB Priority Species and SSSI and SPA interest features. Specifically breeding & wintering waders and wildfowl alongside scarce invertebrates, water voles, European eel and notable plant species.

Species targets

- Breeding **lapwing ≥65 pairs** in the final year of the plan
- Breeding **redshank ≥75 pairs** in the final year of the plan
- Breeding **oystercatcher ≥5 pairs** in the final year of the plan
- Lapwing & Redshank productivity of **>0.8 fledged chicks per pair** annually
- Breeding **wildfowl ≥20 pairs from ≥6 species** in the final year of the plan
- 5-year mean winter maxima of **wintering waders and wildfowl ≥800 from ≥15 species** in the final year of the plan
- Maintain **presence of scarce emerald damselfly**
- Maintain and/or increase **presence of shrill and brown-banded carder bees**
- **Water vole present in 40 out of 87 ditches** with low density presence at a minimum
- Confirm and maintain **presence of European eel**
- Maintain **presence of divided sedge**

Habitat conditions

- Habitat extent:
 - Lowland wet grassland (high water level system) **increased from 91.51ha to 99.60ha** during the life of the plan
 - Lowland wet grassland (winter-flooded +/- scrub) **decreased from 66.94ha to 58.85ha** during the life of the plan
 - Rough grassland & scrub **maintained at 1.53ha**
- Sward conditions:
 - All Cs except E1, SE16, SW7:
 - 1st March; Tussocky sward with median vegetation height <5cm over 90% of the LWG
 - November; Tussocky sward with median vegetation height <10cm over 80% of the LWG
 - 50% of rills, scrapes and other depressions free from *Scirpus*, *Juncus* and dock spp
 - ≤10% cover of *Scirpus*, *Juncus* and dock spp outside of rills, scrapes and other depressions except where management is hampered by ant-hills
 - Hay crop in Cs SE14 & SE15
 - Cs E1, SE16, SW7:
 - Predominantly rough/rank sward
- Surface flooding and water level conditions:
 - Lowland wet grassland (high water level system):
 - According to abstraction licence conditions, begin significant flooding in December (at the latest)
 - January to April; target of 30% (minimum) to 50% (optimum) flooding across all fields in January and maintained into April:
 - Hydro unit 2 @2.1m AOD
 - Hydro units 1 & 3@1.9m AOD
 - Cs SW3/4 @2.0m AOD
 - April to June; drawdown to 5% by the end of June
 - July to December; water levels in the ditch network maintained as high as possible in so far as rainfall allows
 - Lowland wet grassland (winter-flooded +/- scrub)
 - Hydro units 4 & 5:
 - Flooding conditions and extent according to prevailing winter rainfall
 - Water levels in the ditch network maintained as high as possible in so far as rainfall allows (@1.4m AOD)
 - Fields outside of hydro units 1-5:
 - Water levels maintained as per EA landscape drainage system management
 - Rough grassland & scrub Hydro units 4 & 5:
 - Water levels maintained as per EA landscape drainage system management
- Scrub/trees/bramble conditions:

- Lowland wet grassland (high water level system):
 - No scrub, trees or bramble present
- Lowland wet grassland (winter-flooded +/- scrub)
 - Bramble (only) present along the southern edge of hydro unit 4
 - ≤50% scrub/trees/bramble cover in the southern half of C2 and either side of ditches 50, 51 & 60
 - Scrub/trees/bramble present along the eastern and southern boundaries of SE15
 - Scrub/trees/bramble present along the southern edge of SE13 i.e. adjacent to the railway line
- Rough grassland & scrub Hydro units 4 & 5:
 - Scrub/trees/bramble present
- Low levels of livestock poaching
- Ditch senescence (whole site target):
 - Open 10-30%
 - Mid succession 30-60%
 - Choked 20-30%
- No mink present

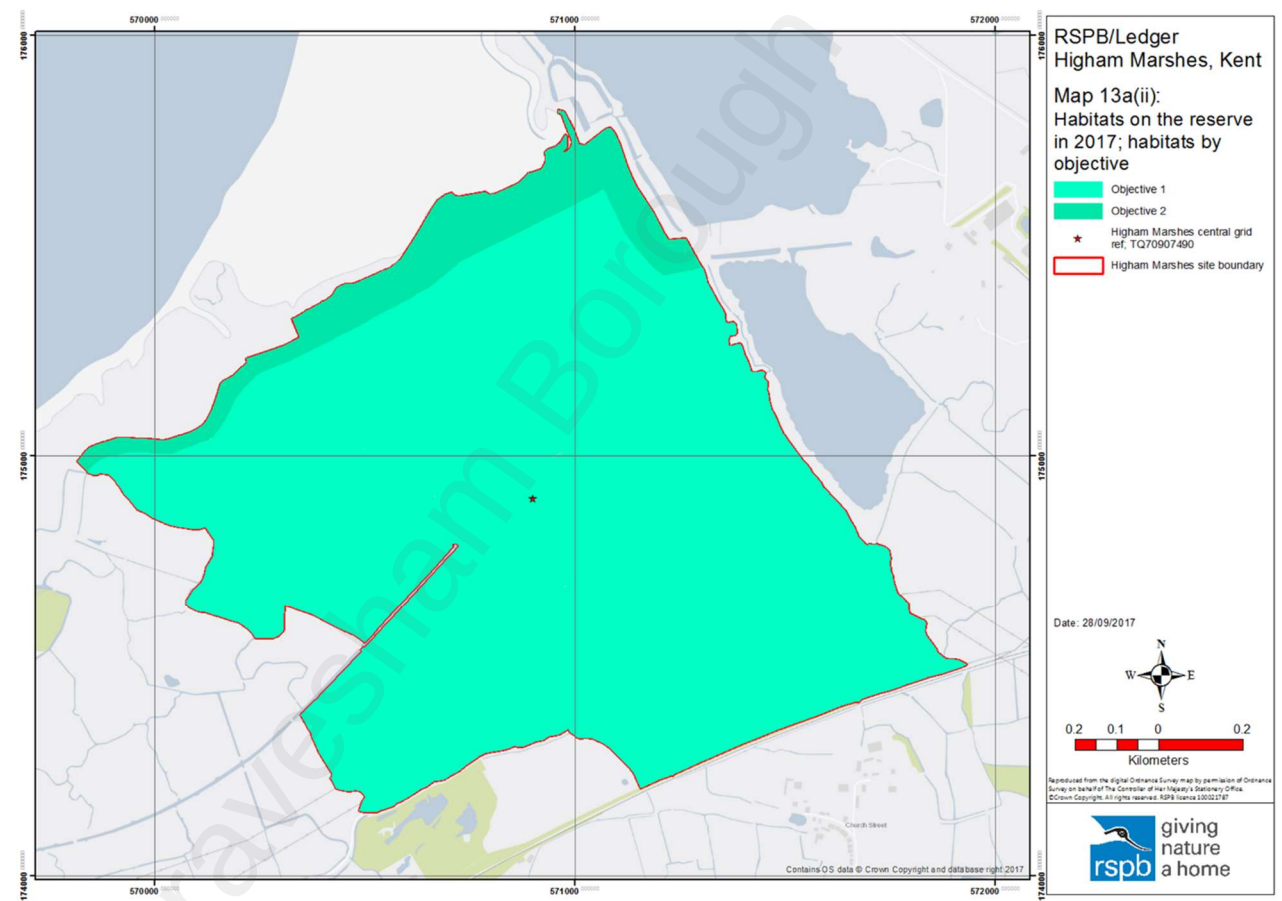


Figure 4: Higham Marshes management plan objective areas.

2.6.2 Targets within context

- Breeding **lapwing** ≥**65 pairs** in the final year of the plan
- Breeding redshank ≥**75 pairs** in the final year of the plan
- Breeding **oystercatcher** ≥**5 pairs** in the final year of the plan
- Lapwing & Redshank productivity of **>0.8 fledged chicks per pair** annually

- 5-year mean winter maxima of **wintering waders and wildfowl ≥800 from ≥15 species** in the final year of the plan
- Water vole present in 40 out of 87 ditches with low density presence at a minimum
- 50% of rills, scrapes and other depressions free from *Scirpus*, *Juncus* and dock spp
- January to April; target of 30% (minimum) to 50% (optimum) flooding across all fields in January and maintained into April:
 - Hydro unit 2 @2.1m AOD
 - Hydro units 1 & 3@1.9m AOD
 - Cs SW3/4 @2.0m AOD

2.7 social and economic context (including access).

Public access is through and around Higham Marshes is restricted to the Public Rights of Way (PRoW) and Countryside Right of Way (CRoW). Shown in figure 5.

No access currently exists across the site excluding the PRoW and CRoW access for a number of reasons

1. The sensitive nature of the land as highly designated places for nature.
2. The need to improve the Partnership Project Area to become fully functioning wetland habitats.
3. The complexities of opening up new access, headlined by the health and safety implications of providing suitable means of access for members of the public and the costs involved in this. The GRCF grant is focussed on habitat restoration and enhancement of the Project Area.

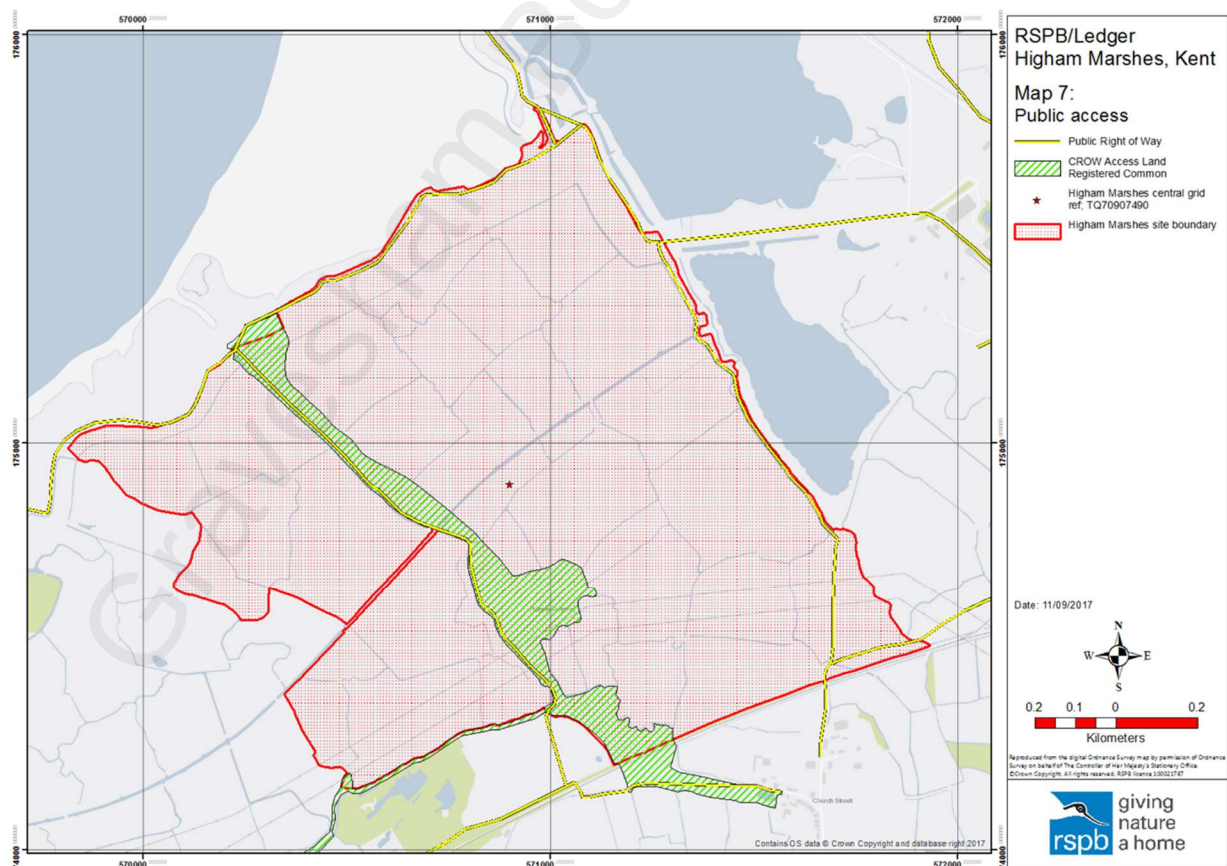


Figure 5: PRow and CRow access on Higham Marshes

In addition, the RSPB has been a small, but key, partner in the development of the England Coast Path along the northern edge of Higham Marshes. The Path, runs parallel to the site's northern boundary and affords excellent views across the new nature reserve and will give visitors vantage points to view such charismatic species such as Lapwing, Redshank, Curlew and as well as Marsh harrier and Kestrel hunting over the marsh.

In addition, access is not entirely based on people roaming across a piece of land, the RSPB's operation already has a number of local people who volunteer with us at Higham Marshes and conduct biological surveys and habitat management – one of the best ways to really appreciate a special place. Volunteering opportunities are, and always will be, available to local people to enjoy their countryside and help preserve it for future generations.

2.8 Planning policy

This is addressed in detail in the document 'Higham_Marshes_Planning Statement'.

2.9 Consolation

The following organisations and individuals have been consulted as part of the assessment process:

- Greener Thames Project Partners
 - Kent Wildlife Trust
 - Essex Wildlife Trust
 - Elmley National Nature Reserve
 - Kent Wildfowling and Conservation Association
- Natural England (NE)
- The Environment Agency (EA)
- North Kent Marshes Internal Drainage Board (LMIDB)
- Medway Swale Estuary Partnership (MSEP)
- Mr B Wright (Tenant grazier)

3. Design Process

The ethos of this project is to transform the area of Higham Marshes in the Partnership's control back into functioning wetland habitats. This entails undertaking engineering works to enhance the in-field topography and disconnect the areas from the landscape drainage regime. This will allow the retention of surface water, being the foremost element of a wetland habitat restoration/enhancement, at the key times of the year – the breeding and wintering seasons. Since the early 1980s at Elmley Marshes on the Isle of Sheppey, this approach to transforming wetland habitats has been tried and tested throughout the RSPB's tenure along the North Kent coast – and many other places in the UK. Other successful transformations in North Kent have been delivered at Shorne Marshes, Higham Marshes, Northward Hill and Great Bells Farm where wetland fauna and flora now proliferate at levels not experienced previously or since the turn of the century – in an environment of widespread species declines.

3.1 Baseline data

To inform how, and to what scope, Seasalter Levels could be enhanced into a fully-functioning wetland, various surveys, assessments and other forms of data gathering have been undertaken – some since our first association with the site in 2007, some more recently. They are

3.1.1 Biological

- Avian:
 - Breeding Bird Surveys (BBS)

- Wetland Bird Surveys (WeBS) including wintering raptors
- Non-avian:
 - Mammals. Specifically, water vole but not exclusive of other species such as badger, bats, harvest mouse etc
 - Reptiles and amphibians. Specifically, great crested newt, common lizard, slow-worm and grass snake but not exclusive of other species
 - Invertebrates. Specifically:
 - Ditch invertebrates
 - Dragon and damselflies
 - Bumblebees
 - Ditch flora
 - Grassland flora
 - Non-Native Invasive Species (NNIS)
- Habitat
 - Ditch condition
 - Topography (LiDAR)
 - Hydrology
 - Soil profile via boreholes

3.1.2. Non-Biological

- Archaeology desktop assessment and in-house site surveys
- Services (Electricity, water etc)
- Unexploded ordnance (UXO) desktop analysis

Whilst most surveys and data gathering exercises are used to ensure that no damage to important features occurs, they also provide the information required to see where improvements can be made for the benefit of the important features. For example, recasting the ditches as contained in the project will provide significant benefit to the important ditch flora and fauna assemblage.

3.2 Evaluation and design considerations

Combining all the deliverables, baseline data and comments over the last few years has led to a design that considers, compensates for and capitalises on a variety of constraints and opportunities within the reserve. The predominant design considerations are discussed below.

3.2.1. Habitat(s)

For a creation proposal, the habitats that could be fashioned would need to be defined. However, as this proposal is a restoration and enhancement of habitats already defined - lowland wet grassland and rough grassland with scrub – this is a given and does not need further consideration in strategic terms. The intricate habitat conditions that we are intending to deliver are discussed in sections 2.5 and 2.6 RSPB above.

3.2.2. Species and/or assemblages

Once a habitat (or habitats) has been defined, it is RSPB's standard operating procedure to define which species will be targeted to drive management of the site going forward if all other considerations fall into place. The decision-making process considers various factors:

1. If the site is designated, what are the designated species/assemblages that would be appropriate to the habitat(s)?

For example, golden-samphire *Inula chrithmoides* is stated in the SSSI citation, but this species will never be found at Seasalter Levels because it requires a very different habitat. As part of our management planning process, the species and assemblages that are appropriate to restore, enhance and Seasalter Levels for are presented in sections 2.5 and 2.6 RSPB above. However, it should be noted that this is not to the exclusion of other species that are likely to take advantage of the enhanced site such as avocet *Recurvirostra avosetta* (SPA & SSSI breeding species) and ringed plover *Charadrius hiaticula* (SPA breeding species)

amongst many others.

2. What is the potential for absent species of conservation concern to colonise or recolonise?

Using Black-winged stilts (which nested on site in 2016, but failed at egg stage) as an example to illustrate the point, we would expect the proposal to make Higham Marshes much more favourable for stilts to colonise. Additionally, and for example, it is not unreasonable to expect avocet to colonise and breed at Higham Marshes in due course.

3. Are there any conflicting habitat requirements?

Even on a single habitat type, there are niches within it that provide distinct conditions for different species and/or assemblages. Too much change in favour of one species or assemblage could be detrimental to another and requires a balance to be found.

The classic example is the perceived conflict between management for water voles and breeding waders where grazing and high water levels are required for the latter whereas intensive ditch bank grazing and water levels so high that space is not left in banks for burrows to be made is highly detrimental to the former. By providing a mosaic of conditions via sympathetic management and habitat design, both water voles and breeding waders can flourish.

In this proposal we have utilised the extant topography and the scope of peak surface water with the creation of banks within high water level areas and exploited the low-level main rivers to provide the mosaic required. In addition, the grazing regime will be extensive, and, in combination, all of these factors remove any detriment to either target.

3.2.3. Hydrology (incorporating neighbouring land use)

Being defined as a lowland wet grassland site and given the species/assemblages being targeted for increases in populations, the prime consideration is understanding the prevailing catchment(s) drainage system(s). Higham Marshes was isolated from the surrounding drainage system in 2014, when the RSPB entered into a management agreement with the land owner. Work to carry this out are shown in Appendix 1.

Therefore, the main aspect of the groundworks design is to improve the hydrological units show in Appendix 1.

The hydrological regime is underpinned by appropriately licensed abstractions to lift water from the lower managed system into the wetland, 'higher-tier' system. These higher-tier systems will require a steady and sufficient supply of water to be lifted (pumped) from the local catchment to maintain appropriate levels of surface water during the critical seasons of winter, spring and early summer – December to June inclusive. Outside of these periods, no surface water is necessarily required, and the fields are maintained as dry or predominantly dry. The targets stated in the management plan objectives are achieved by beginning pumping in November/December to raise surface water from @0% cover up to 50% cover during January. This 50% cover is then maintained into March and then the drawdown is controlled to leave 5% cover in June. Without this process, any lowland 'wet' grassland will not fulfil its potential for both wintering and breeding wetland birds - as being evidenced at Seasalter Levels now.

Environment Agency abstraction license for the site is found in document Higham_Marshes-Abstraction_License.

No further water is currently needed at the time of writing to manage the works appropriately. However with the impact of climate change, this may change in the future. Any changes will go through the Environment Agency Permitting team.

3.2.4. Soils

For any creation, restoration or enhancement of habitat into fully functioning high water tier wetland, the composition of the subsoil is key. Topsoil is expected to be porous, but if the site's subsoil is free draining i.e. peat or sand, then no matter how many lips, bunds, dams or culverts are installed, any surface water applied to the land will just drain away.

The bedrock geology comprises either Chalk (including Red Chalk) or a combination of Oldhaven, Blackheath, Woolwich and Reading and Thanet beds. Soils are loamy and clayey, typical of coastal flats around the Thames Estuary and with naturally high groundwater where drainage is not a limiting factor.

When these soils are wetted continuously, they swell and seal and provide little opportunity for infiltration and seepage. When dry and cracked they are ineffective in retaining water at the soil surface. In field-capacity conditions, air capacity below the topsoil is expected to be low at <1% but in the topsoil may be between 5 and 10%. The hydraulic conductivity of the subsoil is expected to be very low in its swollen field capacity condition.

As stated above, the soils are excellent at retaining standing water providing that they are allowed to swell and seal and, because of this, are also extremely good for creating small-scale hydrological control structures such as dams and bunds.

3.2.5. Topography

Extant topography on a site is a crucial factor that defines how much or how little the field levels need to be manipulated to realise a wet grassland habitat's potential. The ideal scenario will have fields that have a wide variety of levels across the majority of each field. However, too many extremes in depths are undesirable. The ideal variation is within a 500mm band below the predominate surface level of the field. The variations should also be shallow rather than steep-sided i.e. a series of 500mm deep channels in a field is sub-optimal if the batters of the depressions are greater than 1:5. These depressions are so valuable on a wet grassland site because:

1. They hold water which holds a food source, either small aquatic invertebrates or seeds in suspension, with shallow expanses providing significant magnitudes more food than thin, linear features.
2. The batter areas provide another source of invertebrate biomass in the soils that, being damp, are easy to probe into. Wide, shallow batter areas provide easy foraging access with significant magnitudes more food than narrow, sharp batter areas.

Conversely, if the fields have too little variation above the surface level, it is likely that any surface water held therein will be in the form of extensive sheet flooding. This could easily cover the majority of a field's surface and, not only be detrimental to a wide variety of fauna and flora but be detrimental to the species that are being targeted for management. In very simplistic terms, whilst waders need an adequate provision of water in the spring, they nest on dry land.

Across the project areas, there is a combination of too little topographical variation and, where present, sub-optimal topographical variation. As such, a series of rills, scrapes and islands will form an inherent part of the design. As discussed above, a very good example of habitat transformation that has provided inspiration for the scheme is Great Bells Farm on the Isle of Sheppey and that scheme is shown in Figure 6 below.



Figure 6: Great Bells Farm Nature Reserve on the Isle of Sheppey. The image on the right shows the site before transformation and the image on the left shows the site immediately after transformation activities.

3.2.6. Archaeology and Unexploded Ordnance

From experience on other sites where landscaping is required, the two factors of extant archaeology and the potential for unexploded ordnance to be unearthed need to be accounted for in any design and its delivery.

Archaeological features are generally easier to establish, and the features identified in the map and gazetteer (presented in the document 'Higham_Marshes_Archaeology Gazetteer')

Having identified the known archaeological features and assessed the likelihood of unidentified archaeology, the presence of archaeology does not present an insurmountable obstacle in designing viable new wetland features and, conversely, with a sympathetic design i.e. creating rills and excavating scrapes to a shallow depth and avoiding identified features, the creation of the new wetland features do not present a risk to the extant archaeology. Furthermore, it is accepted that archaeological features in a wetland environment are better protected against deterioration. Overall, this project fulfils the RSPB's objective to ensure the preservation of all its archaeological assets.

Considering the location of Seasalter Levels, the risk of encountering unexploded ordnance (principally WWII) must be ascertained to ensure that the works can be undertaken safely and that any UXO burden does not make the project unviable financially. By commissioning two reports to provide information about all the areas of Seasalter Levels, the site has been assigned a medium risk of finding unexploded ordnance. The reports are presented in the document 'Higham Marshes UXO Risk Assessment -. The risk level attributed is as much for the lack of records as for the data that is available. Given the advice contained within the reports, the level of UXO risk can be managed both physically and financially and the project remains viable.

3.2.7. Built infrastructure

Built infrastructure includes a wide range of fabrications from archaeological features to buildings – any of which, in quantity, could render a site unsuitable for wetland restoration. For example, approximately 1km to the north of Cliffe Pools on the Hoo Peninsula is an area of land similar in size and habitat to Seasalter Levels that could easily be the subject of a proposal similar to this one. However, this is the site of the former Curtis's and Harvey Ltd Explosives Factory with over twenty roofless buildings remaining which makes it unsuitable despite being an appropriate habitat and having appropriate soils and hydrological potential. Whilst some are obvious, some are not i.e. underground utilities and land drains.

The built infrastructure present at Seasalter Levels comprises:

- A cattle corral/sheep pen in the south eastern quarter next to the Denton cut main river,
- Train carriage, next to corral, again outside of the works area.
- A seawall just on the northern edge of the site and outside the project area.
- Overhead High Voltage power lines and poles running to the south of the site, outside of the works area.

There are no underground utilities across the site that present impediments to producing a design for the wetland enhancements, see document Higham_Marshes_Line Search.

4.Design elements

The ethos of this project is to restore and enhance Higham Marshes. Wetland systems, like farmland 'become tired' from the same activity happening over and over. Nutrients get locked up in the ground reducing the suitability for breeding waders. The works will entail undertaking engineering works to enhance the in-field topography. This will allow the retention of surface water, the foremost element of any wetland habitat restoration/enhancement, at the key times of the year – the breeding and wintering seasons.

4.1 Hydrological controls

some of the hydrological control systems put in place during the initial restoration phase in 2013/14 have been damaged from use and now need replacing and upgrading. Drawings found in document Higham_Marshes_Design_Specification

NE4 – Install Culvert – **Drawing CUL2**
SE5 – Install Culvert – **Drawing CUL1**
NW – Repair bund – **Drawing BUN1 & BUN2**
NE – Repair bund – **Drawing BUN1 BUN2**

4.2 Habitat enhancements

The features listed above constitute the hydrological strategy whilst another set of elements augments the strategy and constitute the enhancements that will bring the habitat up to the highest quality. These are:

- **Rills and scrapes** – shallow excavations that will provide increased topographical variation and resilience to maintain surface water as water draws down over the breeding season. Starting in November, water levels will be raised to reach the peak extent by January/February and, beginning in April, water levels will be lowered steadily under full control until July when no, or little, surface water will be present across the fields. Subject to rainfall, some water will remain in the base of the rills and scrapes, but this will not be actively

managed. Good levels of water will remain in the ditch network within the hydrological units, but the field surface will remain dry, or predominantly so, until November when the cycle is repeated. Whilst extensive surface water is highly valuable, if it is too shallow, such as would be created if only the strategy element was delivered, the surface water will evaporate too early for breeding waders to complete reproductive cycles. This will become more pronounced according to climate change predictions. Therefore, the increased topographical variation will compensate for this and provide much improved feeding opportunities. Design principles for rills and scrapes include:

- **'Islands'** – shallow features that will remain above the peak surface water level to provide safe roosting and nesting locations. These are most necessary where the surface water becomes too extensive. Design principles for islands are relatively basic:
 - Crest height is -100mm - 200mm above the peak surface water level per hydrological unit.
 - Batters of the islands are either 1:10 or 1:20
- Using the natural topography of the site, from remnants of when the site saltmarsh/land drainage systems to expand the rills system. Field and length below including scape size. Using a tractor mounted spoil spreader to carry out the works.
- The rill system will mainly be made through the use of a tractor mounted soil spreader. Some rills will be created using a 22 tonne 360 to produce the spoil for the crossing points and plugs.
- Works have been broken down into Priority 1 and Priority 2.

Priority 1 works

- **NE1**
 - Rill length – 440 meters – soil spreader
 - Scrape size
- **NE4**
 - Rill length - 465 meters – soil spreader
 - Rill length – 100 meters – 360 – **Drawing RIL2**
 - Rotovate – 0.2 hectares
- **NE5**
 - Rill length – 581 meters – soil spreader
 - Scrape size – 0.4ha
- **NE6**
 - Rill length -450 meters – soil spreader
- **NE7**
 - Rill length – 330 meters soil - spreader
 - Scrape size
- **NE8**
 - Rill length - 148 meters soil spreader
 - Rotovate - 0.4 hectare
- **NE9**
 - Rill length – 150 meters – 360 - **Drawing RIL2**
 - Rotovate – 0.8 hectares
 - Islands – create 8 islands within scape with site won material
- **NE10**
 - Rill length – 300 meters – soil spreader
 - Scrape size – 0.2 hectares
 - Rotovate – 0.4 hectares
- **NW1**
 - Rill length – 400 meters– soil spreader
 - Scrape size – 0.1 hectare
- **NW2**
 - Rill length – 500 meters– soil spreader
- **NW3**
 - Rill length - 380 meters– soil spreader

- Scrape size – 0.12 hectares
- **NW4**
 - Rill length – 400 meters – soil spreader
 - Rill length – 65 meters – 360 - **Drawing RIL2**
 - Scrape size – 0.12 hectares
- **SE4**
 - Rill length – 900 meters
 - Scrape size – 1.2 hectares
- **SE8**
 - Rill length – 600 meters of new rills
 - Scrape size – 0.3 hectares

Priority 2

- **NE1**
 - Rill length – 400 meters – soil spreader
 - Scrape size – 0.12 ha
- **NE4**
 - Rill length - 250 meters – soil spreader
 - Scrape Size – 0.9 hectares
- **NE5**
 - Rill length –280 meters – soil spreader
 - Scrape size – 0.18ha
- **NE6**
 - Rill length -60 meters – soil spreader
 - Scrape Size – 0.15 ha
- **NE7**
 - Rill length – 360 meters soil - spreader
 - Scrape size – 0.06ha
- **NE8**
 - Rill length - 148 meters soil spreader
 - Rotovate - 0.4 hectare
- **NE10**
 - Rill length – 300 meters – soil spreader
 - Scrape size – 0.2 hectares
 - Rotovate – 0.4 hectares
- **NW2**
 - Rill length – 200 meters– soil spreader
 - Scrape size – 0.2 hectares
- **NW3**
 - Rill length - 630 meters– soil spreader
 - Scrape size – 0.15 hectares
- **NW4**
 - Rill length – 150 meters – soil spreader
- **SE4**
 - Rill length – 50 meters
 - Scrape size – 0.05 hectares
- **SE5**
 - Rill length – 970 meters
 - Scrape size – 0.25 ha
- **SE8**
 - Rill length – 200 meters of new rills
 - Scrape size – 0.05 hectares

4. Design

The full Partnership Project Area design is presented in the three documents:

Detailed designs are presented in the document: Higham_Marsh_Design Specification, comprising:

1. Block plans:
 - a. Itemised scope of works in relation to any Public Rights of Way, Main Rivers and archaeological assets that are present showing the whole area at a scale of 1:3,750.
 - b. Itemised scope of works including cross-section locations at a scale of 1:2,500.
2. Habitat Design plans
 - a. LiDAR-derived topography data
3. Cross section drawings for features
4. Schedule of Works

Appendix 1

